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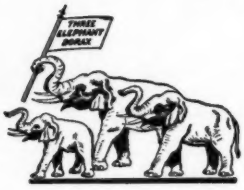

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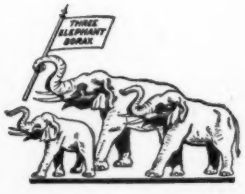

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington, D. C.

VOLUME XXVI NUMBER 5

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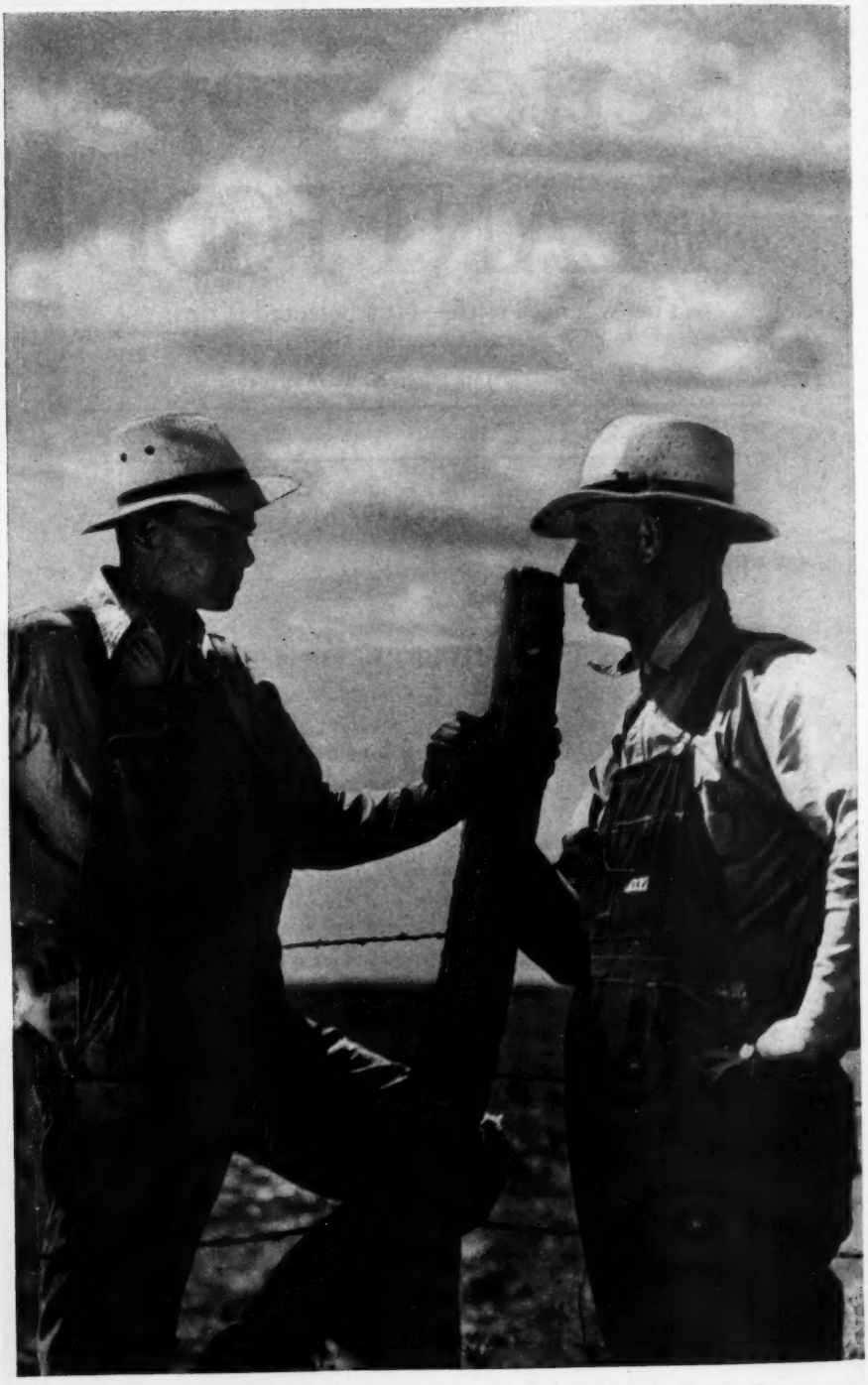

Determined plans for victory are not all made near the battle front.

Better Crops with PLANT FOOD

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VOL. XXVI WASHINGTON, D. C., MAY 1942 No. 5

There're jobs aplenty for those in . . . . . .

The Senior Draft

Jeff McDermid

SOME of us have just signed the roll of the Great Unwanted. By that I refer to the last-ditch resource of American manpower, to which hosts of us so-called "Oldsters" were classified during the last days of April.

When I read that scathing term in the headlines a few weeks ago it startled me into full realization that my age had found me out. From this time hence I shall be cataloged with the ancients and remain unable to deny it by any ordinary form of subterfuge or foolish camouflage.

It will do me no good hereafter to wear nobby hats with colored feathers in the bands, don youngish raglan topcoats with gaudy plaids or stripes, patronize the nifty floor shows, whistle jazz tunes, attempt to jump fences, or wink at young women.

Nay, the lists are loaded with fateful names and the wise old world is now aware that we who were young firebrands in the days of Foch and Pershing are rusty and moss-grown relics in the national arsenal.

When I think of the instances when I have been able to cut enough capers to belie my seniority, or have perjured vital statistics to retain junior standing, it grieves me to thus have the veil of secrecy torn asunder by Uncle Sam. Had I been as young as I felt I ought to be, I might have thrust myself into the third draft category instead, safe in the knowledge that I would be sent home anyhow on account of sinus trouble and flat feet. But the social admonition of my wife to be "my own

age" has driven me into the "rheumatic reserves." Here I stand at attention, alongside of other ardent but archaic and arthritic patriots bearing the wrinkled necks, liverspots, and bloated paunches of two score years and five, plus more.

Of course a few of us "reservists" gleaned some slight consolation from the flattering attention of certain young damsels who helped out in the draft board records office. Just a few of us who still retain a little hair above the eyebrows and a good set of teeth felt somewhat easier when these girls claimed to be astonished when they put down our true and legal birth date. However, it may have been but a flicker of the same sympathetic cajolery with which the dainty young nurses administer sedatives to tired middle-aged businessmen in psychopathic wards. Women are all alike in this respect, that they like to mother folks more or less from the cradle to the grave.

YET my spirit is more resilient than my body, and this experience does not get me down. Especially when I happen to think that I'm still young enough not to be left off the roster entirely! It's "what you ain't" that comforts a fellow more often than what you are. Therefore, I shall await the coming of those index cards to see what kind of occupation may still be open to one whose chances of saving the country are none too good.

It has been the fate of Oldsters and Boys to be left behind in countless wars. Theirs was the proud and pathetic duty of serving as home guards or doing the work of able-bodied recruits in store and shop and mine and farm. But not since the savage Indian wars of New England and the western Plains have the stay-at-homers been in such likelihood of being actual physical defenders of the hearth and the heath. For recent tragic attacks on civilian zones indicate that we are in for more chances to "smell powder" than occurred to noncombatants in the brave days of old.

This war also brings about the first real official classification of the men considered by ordinary vital statistics of the wear and tear of life to be "past masters" of the legion. We are familiar with the ritual of the lodge of liberty and have served our time as active supporters of its creed. No stigma attaches to those who have thus served their day and age unless they assume a narrow reluctance to hand on the insignia to younger and more capable leaders.

When we acknowledge our limitations without flinching and refuse to be daunted by creaking joints and puffing breath, it leaves us freer to use our still-seething brainpower to accept duties and tasks suitable to the talents and the background of patriotic past masters. For we know that the same world that envies the eagle and the hawk also finds solace and value in the humble domestic fowl. Maybe we can't soar and dive and pounce, but we've got some stamina left for pecking and scratching gravel.

WE glean more comfort from the thought that some noble gents are in our classification these days, including the President, Vice President, most of the Cabinet, and a brace of top-notch generals like Douglas MacArthur, et al. However, that doesn't signify that age alone qualifies for brilliant leadership, which sends us again into some soul-searching reveries.

It simply indicates that man's span of life in which to get wise to a lot of things is very short indeed. Almost before we get used to being of voting age we approach the middle years, and lo and behold, from that time on the slope becomes steeper and the coasting into elderly attitudes gets swifter. I really suppose that the only sound qualification a chap has for leadership and respect in later life consists of his ability to take it gracefully and philosophically. When he grows hidebound in his ideas and resentful of younger command, it means that his egotism has dwarfed his patriotism.

One of the hardest things to learn

in this war of power politics and racketeering is that the lone individual seldom counts for much. All these irksome controls and restrictions and regulations are calculated to impress one with this same tough situation. It's the mass and the total might of an unswerving race or nation that goes forth to battle actively and economically these days, no matter who began it that way. We who partook of the personal "success story" era of America and nursed great private ambitions to get us a nice niche somewhere must now unlearn all that tripe and be content to hustle with the herd. But here is a nice discrimination bobbing up—how may we submerge our ego and at the same time not neglect a decent amount of personal responsibility? Can one be a dynamic atom, as it were?

Yes, I think we can all fix it so we can be dynamic atoms whether we shoulder arms or plow corn. If we can't be dynamic except while we are just thinking it through, that's something to conjure with. America is going to need plenty of advance thinking as well as immediate acting, and it may possibly be some of us stay-behinds who uncover a few rich veins of mental minerals for future development. Anyhow, the elder civilian who lets the draft close up his reservoir of thought and conjecture is entitled to rejection and earns his discharge, *non compos mentis*. And that's just as bad as A. W. O. L. or "drunk and disorderly."

In peace time, if left to ourselves to grow elderly in the normal American way, too many of us seniors get crusted over with affairs inside our own fence lines. We grow aloof and preoccupied with dreams of the past and pottering around with selfish chores and private diversions—such as keeping up the lawn and the flower beds or fulfilling some neglected hobby.

All this we do quite innocently to be sure; thinking all the while that this is a patriotic thing to do, to improve some nook or develop some corner—and raging at the other guy for tossing over dead cats and old tin cans. If they issue a call for a neighborhood caucus or community rally, we either stay awake and sulk and stew or we go there awhile to glower and grumble at new ways of doing old stunts. It's all very human and natural, because older folks are expected to get dull and conservative and caustic, because this is the land of liberty and those who have enjoyed it the longest should cling to it the hardest. That is, if you mean personal liberty to live unto yourself alone.

But here and now in this crisis we have to take a new lease on life. We have a real chance to live more fully and keep awake and alert, even if we don't live any longer. Yes, we can afford to neglect the fence corners of our property rights and hustle into the streets and highways to mingle with those who share the common lot of morale building. We can forget to look into the glass for more wrinkles each morning and begin limbering up for liberty in a new way.

THIS new kind of freedom will mean that we have time and inclination to assist the widow and the orphan bereft by the present catastrophe, to study new lessons of progress and defense, time to use our experience on some community problem, and time to work with those younger fellows belonging to the draft-to-come.

Those who have been fortunate enough to associate constantly with Youth as 4-H leaders or Boy Scout executives certainly have an opportunity—not only a direct one with their chosen charges, but perhaps a sort of destiny as trainers of some of the rest of us to go and do likewise.

Not all of us Oldsters are fitted for this critical job. I would not

(*Continued on page* 45)

The residual effect of 200 pounds of 0-20-20 per acre applied at the time of seeding resulted in more than a doubling of the yield of clover hay on the Leo Wellman farm in Wood County in 1941. The yield of oats was increased from 42 to 65 bushels per acre on this same field in 1940.

Soil Bank Investments Will Pay Dividends

By C. J. Chapman

Wisconsin College of Agriculture, Madison, Wisconsin

TOO much of our seed is falling by the wayside, on barren rocks, and among the thorns of a depleted and impoverished soil. We of America have been exploiting the riches of our once-productive, fertile farm lands.

Federal authorities tell us that in the United States more than 50 million acres of farm land which at one time supported farmers and their families have already been laid waste and are no longer fit for agricultural purposes. They tell us that an additional 100 million acres of farm land are well on their way to abandonment. When we compare this acreage of ruined land with the limited acreage of land devoted to farm crops in England (expanded now to about 18 million acres in crops), when we think of Japan with a population of 72 million living off less than 16 million acres of arable cropland, when we think of the State of Wisconsin with its 11 million acres of cropland, we may catch a glimpse of the tremendous and appalling waste and destruction of farm lands that has taken place in the United States.

As never before in history, we Americans are now faced with the problem of adjusting ourselves to a program of economy and self-sacrifice. We are not at present worrying about a shortage of food supplies, but we are con-

cerned about shortages and restrictions of certain other commodities which are causing no little inconvenience and even hardships, and this situation will get steadily worse as the war progresses.

We are pouring the current and borrowed resources of our present income, as well as the incomes of generations to come, into what may well turn out to be a cataclysm of the whole world's political, social, and economic structure. But this war will eventually end, and the peoples of the earth will assume the task of reconstruction. Nations will adjust themselves to their inherent and local resources; a new political economy will be molded out of the wreckage of war-torn countries. However, the soil resources of every nation will again play a big role in the pattern and fabric of a reconstructed economy. The debts incurred by our own nation must be paid or adjusted. The cost of this war will eventually be levied against every living survivor, as well as sons and grandsons of generations to come.

In a recent talk before a group of 800 boys and girls and their parents at a 4-H achievement day gathering in one of our Wisconsin counties, I tried to draw a picture of what had been happening to the soils of this Nation, of Wisconsin, and particularly of the county in which these boys and girls and their fathers and mothers live. I pointed out that for three generations we have gained a living from the soils of Wisconsin; that we had built our homes and barns and equipped and stocked these farms all out of the wealth of the virgin soils which at the outset were not too well stocked and supplied with native fertility. But in turning to the future welfare and security of the boys and girls, I called to the attention of the fathers and mothers the debts which we are incurring right now that will have to be paid eventually by their sons and daughters, the farmers of the next generation. And I appealed to those parents to invest some of their present incomes in lime and fertilizer and thus build up the fertility of soils that will be heavily called upon in the inevitable lean years of a post-war depression. "Bank in the soil, and we will have soils we can bank on in years to come."

Barley on the Hans Olson farm in Dane County gets off to a vigorous start on the fertilized plots. Yields were: no treatment—45.6 bu. per acre; 0-20-0 at 200 lbs. per acre—68.8 bu. per acre; 0-20-20 at 200 lbs. per acre—73.0 bu. per acre.

Thousands of farmers in Wisconsin have limed all of their acid soils. In fact, Wisconsin farmers have applied more than 5 million tons of lime in the past 7 years, but still this tonnage of lime has sweetened only about 2 million out of a total of 8 or 9 million acres of acid soils.

Tests on more than 191,000 soil samples from all parts of the State indicated that 65% of our farm lands are still acid. The tests for available phosphorus and potash on these same 191,000 soil samples showed 75% to be deficient in available phosphorus and 49% deficient in available potassium. But Wisconsin farmers are responding to our educational program for the increased use of commercial fertilizers. The tonnage of commercial plant food used has increased rapidly in the past three years; in fact, has doubled in two years. In 1939 Wisconsin farmers used a total of 42,623 tons of commercial fertilizers. In 1940 the tonnage increased to 64,253, and in 1941 84,120 tons were used. No doubt the tonnage in 1942 will go to more than 120,000 tons. But even 120,000 tons are less than 20% of the plant food needed to offset annual losses which are being incurred in the sale of farm produce and in the handling of animal manures produced on our farms.

That fertilizers are needed and can be used with profit on Wisconsin farms has been demonstrated without any question or doubt. Hundreds and thousands of field trials have been conducted throughout the State during the past few years. They have shown a need for and the profitableness of using commercial fertilizers. In fact, in actual field tests on small grain on more than 1,000 Wisconsin farms in the past two years, the value of increases in yield of grain alone has more than paid the entire cost of the fertilizer treatment in 86% of these tests. When the residual carry-over effect of the fertilizer on the hay crop the following year was checked and measured, we found that in 95% of the tests the fertilizer more than paid for itself. It has been interesting to observe that in about 60% of these demonstrations the largest increases were secured where potash was used in addition to phosphate.

The application of 125 pounds of 0-20-20 per acre (left) made a big difference on this field of corn on the Otto Haberkorn farm in Fond du Lac County.

In many of our demonstrations con-

TABLE 1.— AVERAGE OF 423 DEMONSTRATIONS (9 YEARS, INCLUDING 1941) WHERE A COMPARISON WAS MADE OF 0–20–0 AND 0–20–10

Crop	Treatment	Rate per acre (lbs.)	Average yield (bu.)	Increase yield (bu.)	Average yield straw (lbs.)	Increase straw (lbs.)	Value of increases grain + straw [1]	Cost of fertilizer	Net profit per acre
Oats and barley	0–20–0	200	50.6	10.0	2,517	431	$5.65	$2.50	$3.15
	0–20–10	200	54.1	13.5	2,675	589	7.63	3.60	4.03
	Check	.....	40.6	.....	2,086	.....	.....	.....	.....

[1] *Oats and barley figured at average value of 50¢ per bushel, straw at $3 per ton.*

ducted during the past nine years, we used only one treatment. In fact, the 0-20-10 combination has become a popular fertilizer for grain and legume seedings in Wisconsin, and in many counties this was the fertilizer used for comparison with no treatment. However, in some of the demonstrations a comparison was made between 20% superphosphate and 0-20-10, and Table 1 shows the average results of 423 such comparisons. Here we observe that the straight 20% superphosphate has given an increase of 10 bushels per acre in yield of barley and oats with a net profit of $3.15 over and above the cost of the fertilizer. Where the 0-20-10 mixture was used, there was an average increase of 13½ bushels with a net profit of $4.03 per acre.

It should not be concluded from the above data that all soils in Wisconsin are responding profitably to fertilizer. In this summary we have included a number of test plots where no profit was shown. However, on a high percentage of these test plots on a wide range of soil types over the State, fertilizers have been used with profit and increases in the yield of grain alone have paid for the fertilizer.

Where the residual carry-over effect has been measured and the value of the increase in yield of hay has been added to the value of increases in grain, we observe that the relative response to potash is somewhat greater and, of course, net profit considerably higher for the 0-20-10 mixture.

The actual amount of potash carried over and available to the hay crop the second year is small where 0-20-10 is used at 200 pounds per acre, but one of the benefits of this potash in the mixture seems to be in the establishment of

(*Turn to page* 41)

TABLE 2.— RESIDUAL CARRY-OVER BENEFIT TO HAY CROP (9 YEARS, INCLUDING 1941). TOTAL VALUE OF HAY, GRAIN AND STRAW AND PROFIT OVER COST OF FERTILIZER (88 PLOTS)

Soil type	Treatment	Rate per acre (lbs.)	Average yield grain (bu.)	Value of increase grain + straw [1]	Average yields of hay (lbs.)	Pounds increase hay	Value of increase, grain, straw, and hay [2]	Cost of fertilizer	Net profit per acre
Mostly silt and clay loams	0–20–0	200	53.4	$6.04	4,196	882	$10.45	$2.55	$7.90
	0–20–10	200	56.7	7.97	4,572	1,258	14.26	3.70	10.56
	Check	.....	42.4	.....	3,314	.....	.....	.....	.....

[1] *Oats and barley figured at average value of 50¢ per bushel, straw at $3 per ton.*
[2] *Hay at $10 per ton.*

Nutritional Information From Plant Tissue Tests[1]

By Paul T. Veale

Assistant in Soil Survey, Purdue University, Lafayette, Indiana

A SOIL surveyor is constantly confronted by farmers with questions relative to the fertility of the soil. Although the surveyor has much information bearing on that question derived from many soil characteristics that are associated with the different soil types, the management history of any particular soil becomes an important factor in its current fertility situation.

The Purdue plant tissue test[2] has been found valuable in obtaining additional diagnostic information on the current fertility status of soils, and the determinations can be made in the field where they are most helpful in passing on to farmers information valuable in their fertility programs.

In the summers of 1939 to 1941 plant tissue tests were made on field crops in Newton, Noble, and Parke Counties, Indiana. While conditions on several soil types were studied, special emphasis was directed to obtaining many tests on one important soil type in order to get a more significant picture of its fertility level. Other reasons for this study were to determine if a particular soil type showed any characteristic pattern relative to the availability of nitrogen, phosphorus, and potash, and to find if this method would be a practical aid in improving the soil survey service to farmers.

Since the number of tests was limited, it was felt the data would be more significant if grouped according to the soil characteristics; and since these types are of similar geological age, they have been assembled into relative-drainage-profile groups according to Bushnell.[3]

Group V (Terrace and upland soils, excessively drained as in the Fox series.) The soils of this group are the best oxidized soils of the whole list, due to the porous nature of the soil and the underlying material which may consist of gravel and sand or stones. In order for a V-profile to develop in flat land it is, of course, necessary that the water table be low enough so that underlying sand or gravel is dry and not saturated with moisture.

These soils are commonly characterized by level to steep topography (0-25% slope), slight to excessive surface drainage, brown surface color,[4] light brown subsurface color,[4] reddish brown subsoil color, good to excessive internal drainage, medium to low productivity, none to moderate erosion, with droughtiness, acidity, and low fertility as the major farm problems.

Group IV (Rolling, light-colored, well-drained upland soils of north central Indiana as in the Miami series.) Group IV soils may be considered as the best drained, aerated, and oxidized group with the exception of Group V soils. Their development correlates very closely with a degree of slope which insures rapid run-off of rainfall and good aeration most of the time.

These soils are commonly characterized by moderately to steeply sloping topography (4-15% slope), good to

[1] *Journal Paper No. 16, Purdue Univ. Agr. Exp. Sta., Lafayette, Indiana.*

[2] *Scarseth, George D. Soil and Plant Tissue Tests As Aids in Determining Fertility Needs. Better Crops with Plant Food. March 1941.*

[3] *Bushnell, T. M. An Outline of the Classification of Indiana Soils. Indiana Acad. of Sci., Vol. 49, 1940.*

[4] *These descriptions apply to timber soils only, the color being much darker with prairie vegetation.*

Typical group V soil. Note 12 to 14 inches of brown, fine sandy loam surface and horizontal bedding of sand and gravel in subsoil.

rapid surface drainage, brown surface color,[4] light brown subsurface color,[4] unmottled subsoil, good internal drainage, high to medium productivity, slight to severe erosion, with erosion control, acidity, and fertility as the major farm problems.

Group II (Level, light-colored [4] upland soils typical of north central Indiana as in the Crosby series.) These soils are commonly characterized by level to gently sloping topography, slow surface drainage, light brownish gray surface color,[4] mottled subsurface, slow internal drainage, usually claypan in subsoil, medium to low productivity, none to slight erosion, with low fertility and artificial drainage as the major farm problems.

Group VIII (Formerly ponded, dark,

A group IV soil. Surface is light brown silt loam over glacial till with high lime content.

depressional upland soils as in the Brookston series.) These soils are commonly characterized by slightly depressed topography, originally ponded surface drainage, deep, dark gray surface color, mottled yellow, brown, and gray subsoil, very slow internal drainage, high to medium productivity, none to slight erosion, with artificial drainage as the major farm problem.

Group X (Muck soils.) These soils are commonly characterized by depressed topography, originally ponded surface drainage, black organic surface, black organic subsurface, dark brown organic subsoil, very slow internal drainage, high to low productivity, none to severe erosion (wind erosion), with artificial drainage being the major farm problem.

Bottom land soils, such as the Genesee series, are depositional soils commonly characterized by level topography, occasional to frequently ponded surface drainage, brown to gray to black subsurface color, light brown to mottled subsoil, no development of weathered horizons, high to medium productivity, no erosion, with protection from overflow as the major farm problem.

Plant Tissue Tests Made

Plant tissues from general field crops were tested at random on the various soils. Great care was taken to get representative samples of both good and poor fields of various crops. The tissue tests were then made on two or more plants from each field to be sure the samples were representative. The tests for nitrogen, phosphorus, and potassium were not considered limiting unless *the test rated very low or none;* any tests rating "low" to "medium" were interpreted to mean the supply was not limiting plant growth.

The nitrogen test was not used on legumes as legumes do not contain nitrate nitrogen, and it was assumed that they could acquire sufficient amounts from the air. On the bottom land soils corn was the only crop tested.

Since only 195 fields on 26 different kinds of soils were tested, it was felt that the data would be more significant if grouped according to the soil drainage profile characteristics. To determine if this system of grouping was adequate, 64 tests were made on Fox sandy loam and the results compared to its drainage group. This soil type had almost the same nutritional pattern as other soils of this group, indicating soils of similar geological age and drainage have a similar nutritional pattern.

Since plant growth is governed by the limiting factor, whether nutritional or physical, it seems desirable to analyze many potentialities. If one nutrient which is limiting growth is supplied, the plant will be able to respond only so far as the other factors will permit. For example, if nitrogen and potassium are both limiting, the application of potassium alone or nitrogen alone will not give as complete a response as if both are supplied. If water is the limiting factor, the additions of nitrogen, phosphorus, or potassium or some combination of these plant nutrients will help only so far as the moisture will permit. Big crops are, therefore, dependent upon a balanced equation between plant nutrients, moisture, and physical properties of the soil.

From the plant tissue data it was found that 78% or more of these soils were inadequately supplied with either nitrogen, phosphorus, or potassium or some combination of these plant nutrients. With the present low standards of production, the addition of plant nutrients should be our primary concern.

On Fox sandy loam nitrogen was one of the limiting nutritional factors in 68%, potassium 56%, and phosphorus in 19% of the cases. The major nutritional problems on Fox sandy loam, therefore, are nitrogen, potassium, and phosphorus in this relative order. In 81% of the fields tested it was found that one or more of these three elements were limiting plant growth, or in only 19% of the cases did the crops receive adequate balanced nutrition.

In addition to the deficiency in plant nutrients, it should be mentioned that Fox sandy loam is a very droughty soil, and is very dependent upon ample rainfall distributed throughout the growing season. This is especially true if the water table is very low. Considering all of these facts, and since the field tests were made under more or less dry conditions, it would seem that under ample moisture conditions the nutritional limitations would be even greater than found.

Group II and VIII soils. Group II is level, poorly drained silt loam of medium productivity. Group VIII consists of lower-lying adjacent soils of high productivity when drained.

On the "V" drainage profile soils, such as Buckner sandy loam, Princeton loamy sand, and Bellefontaine sandy loam, the same nutritional limitations were observed as on the Fox sandy loam. Taking all the V profile group, nitrogen was one of the limiting factors in 68%, potassium in 60%, and phosphorus in 24% of the cases. In 80% of all the field crops tested in this group, it was found that one or more of the three elements were limiting plant growth, or only 20% of the fields had adequate nutrient elements.

The individual field tests indicated that nitrogen, phosphorus, and potassium were limiting plant growth on 15 fields, nitrogen and potassium on 27, nitrogen on 12, and potassium on 6 fields.

In the "IV" profile group, Miami silt loam, Miami fine sandy loam, and Metea fine sandy loam, a slightly different situation was found. Nitrogen was one of the limiting factors in 60%, phosphorus in 64%, and potassium in 62% of the cases. It seems, therefore, that the nutrient deficiency on the IV profile soils is about the same magnitude for nitrogen, phosphorus, and potassium. One of the most significant facts observed with the IV profile soils was that in 94% of the cases the crops were limited in growth by at least one of the three elements studied.

The individual tests indicated that nitrogen, phosphorus, and potassium were needed for the crops on 7 fields, nitrogen and potassium on 6, nitrogen alone on 2, phosphorus alone on 8, potassium alone on 2, and phosphorus and potassium on 6.

In the "II" profile soils group, which consists of Fincastle silt loam, Ayrshire silt loam, Crosby silt loam, Crosby loam, and Conover loam, nutrient deficiency tests showed that nitrogen was one of the limiting factors in 60%,

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Purpose and Function Of Soil Tests

By W. H. Garman

Associate Professor of Soils, University of Georgia, Athens, Georgia

SOIL fertility can be spoken of as that dynamic property which renders the soil capable of producing high crop yields. What constitutes a fertile soil for one crop may not hold true for other crops. If a soil is properly located for a given crop, and possesses a suitable pH, sufficient organic matter, desirable physical and biological properties and adequate drainage, and contains ample nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and iron, together with certain of the so-called trace or minor elements such as copper, boron, manganese and zinc, it can be said to be a fertile soil for this crop. This, of course, does not imply that this would constitute a fertile soil for other crops.

Just as the nutrient requirements of different crops vary, so do the soils themselves with respect to the amount of available nutrients which they can supply. It has often been said that soils differ from each other much the same as plants or animals differ from each other. For best results efforts must be made to evaluate soils from the standpoint of the crop to be grown. Such evaluation should go a long way toward supplying the basis for prescribing that treatment which will render a given soil a more desirable medium for the production of this crop.

For the past three-quarters of a century soils investigators have endeavored to evaluate soils through the use of chemical methods. Toward this end many different techniques have been employed. On the whole, these methods have been too complicated and time-consuming to be of much practical use on a large scale. Within the past decade numerous modifications of these older methods have been made, and certain newer ones advanced, with the result that today we have procedures for testing soils which can be carried out in a relatively short time.

In the hands of properly trained workers these rapid methods will give a fairly reliable picture of the available nutrient status of the soil, which could be secured in no other such simple and economical manner. This information is of considerable value when employed in conjunction with the basic knowledge which the agronomist already possesses. With the results of these tests before him, to supplement his knowledge in the fields of soil fertility and plant nutrition, he is in a much better position to prescribe fertility needs for a given crop on a certain soil than he would otherwise be.

Plant Tissue Tests

Rapid techniques are also now in use for testing plant tissues for their content of soluble nutrients. Quite commonly these tests are of value in diagnosing nutritional disturbances. Thus they may be used to advantage in supplementing soil test data, especially where these data fail to fully account for the observed conditions.

Naturally, tissue tests are not capable of determining in advance of planting that treatment or fertilization most likely to be adequate for a given crop on a given soil. For this reason they will be of less value in practical agriculture than soil tests. However, where tissue tests are made during the grow-

ing season, information may well be obtained which can be of value in planning fertilization for this crop when again grown on this soil. It has been the writer's experience that where soil tests are made, and the resulting recommendations followed in the field, there is very seldom need for making tissue tests. Where soil tests have not been made, nutritional disturbances are more likely to occur, and it is in such instances that tissue tests have been of greatest value.

Soil scientists who have had considerable experience with rapid soil tests have no doubt as to their tremendous practical value in agriculture. Others may have a tendency to discourage the use of such tests as an aid in prescribing fertilizer treatment or in diagnosing fertility troubles. The use of soil tests has been discouraged chiefly because of two reasons, the more common of which has been due to the lack of actual experience in the use and interpretation of the tests. The second, and less common reason, has been due to the fact that a certain test (such as the potash or magnesium test) has failed to correlate with the need for this nutrient as judged by plant response to applications of it.

Conditions for Correlation

Here, let us ask ourselves this question: Under what conditions could one expect correlation between a single test and field response? The answer is obvious since a high degree of correlation would be possible only where all other elements, as well as growth conditions, were at their respective optimum levels. It is likewise obvious that such a condition will seldom, if ever, be encountered under agricultural conditions, especially on soils which have been subjected to long continuous cultivation and erosion. Therefore, it goes without saying that any one test alone could rarely be used to advantage.

When all tests are made it is quite likely that the limiting elements or element can be singled out and thus supplied. Then, and only then, would one be in position to attempt to correlate the test for a given element with plant response to applications of this nutrient. Making complete tests requires but little time and expense. Had all workers in the past taken time to make complete tests, they very likely could have saved both farmers and themselves time and unnecessary expense, at least in certain instances, and as a result the use of soil tests would be more common in certain localities than is true today.

In spite of the above discouraging elements, active testing services are in operation in many states. In all of these states there apparently has been an ever-increasing demand for this service. In most laboratories several determinations are made on each sample. These usually include phosphorus, potassium, calcium, magnesium, pH, aluminum, and organic matter. In addition, nitrate and ammonia nitrogen are frequently estimated. Recently, widespread evidence of minor element deficiencies has introduced simplified tests for boron and manganese. A determination now made by all laboratories is "lime-requirement." In this determination there is evident need for improvement; however, the same may be said for certain of the other tests. At any rate, it is of considerable importance, since humid region soils tend naturally to become more and more acid, and many soils are today so low in active calcium and magnesium that a prosperous agriculture is impossible.

It should always be kept in mind that many factors (other than available nutrient content) can, and often do, affect plant growth. It is obvious that rapid laboratory tests reveal little or nothing as to such factors as drainage, general physical condition, biological activity, quality of seed used, diseases, weeds, insects, and moisture supply. As many of these factors as possible should be considered in conjunction with the result of soil tests.

All of this adds up to the fact that it is highly desirable to have considerable information furnished along with

each sample that comes to the laboratory. This should include the names of all crops grown; yields received; the kind and amount of all treatments such as fertilizer, manure, and lime applied; diseases encountered; and the rotation and management practices planned for the future. In addition, there should be information on such factors as size, shape, and general topography of the area; depth of topsoil; approximate depth to bed-rock; predominate slope; degree of erosion; whether drainage is normal, excessive, or poor; whether topsoil is uniform in color over the area; whether or not plants have shown peculiar coloring and dying of leaves prematurely; and whether the area is uniform in fertility as judged by the growth of previous crops.

Soil Sampling Important

The matter of soil sampling is one of the most important of all phases of soil testing. Unless a sample is truly representative of the area, it is not worth the time spent in securing it. Since soils are so extremely variable in nature, it is obvious that a sample obtained from only one spot in the field will most certainly not represent the entire field. The chemical tests on such a sample may be twice as high, or much lower, than the average for the field. It can readily be seen that incorrect recommendations would very likely result from the use of such a sample. Too great care cannot be exercised in obtaining samples according to accepted sampling procedures. As soil testing is carried out in most states today it is not possible to have experienced persons available to meet the large sampling demands on the part of the farmers. This means that the farmer must frequently do his own sampling. Under these conditions it is well to contact the Agricultural Experiment Station, where detailed instructions for sampling can usually be obtained.

It would be well if soil-testing services could handle their samples through county agents, extension agronomists, and vocational agricultural teachers. Complete cooperation could be possible only where these individuals were acquainted with sampling techniques and the interpretation of the chemical soil-test data. If all such individuals were in position to properly take samples and to evaluate the results of soil tests, the practical value of a testing service theoretically would be at a maximum. This would result from the fact that these individuals are familiar with many plant diseases, general growing conditions, variety adaptations, management practices, as well as the soils in their respective localities, and thus would be in position to make complete evaluations of the combined factors.

As the public demand for soil testing increases, it will be more and more essential that field representatives make the actual interpretations of the testing results and formulate the recommendations. This will require the laboratory to do only the testing and mailing of the results, together with making brief suggestions in special instances. This will eliminate a detailed letter being written in each case, such as is the general practice today in most states.

Conclusion

From this brief discussion of soil testing, the layman should not receive the opinion that these tests are foolproof in all respects. In fact, in some instances they may be far from that, especially when the results of only one or two tests are considered, or when the history of the sample is not known. However, when the information of all the commonly made tests is considered in conjunction with other essential facts, one is not likely to go far wrong. This, of course, implies that the individual in question is thoroughly trained in all aspects of the laboratory work and in the fields of soil fertility and plant nutrition. In the hands of individuals with little or no experience in these fields, it is very unlikely that results of value would be forthcoming.

Each of the tests has certain limita-

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Close-up of mixed clover hay, second crop 1940, on PK plot.

Potash Extends the Life Of Clover Stands

By Ford S. Prince

Agronomist, Agricultural Experiment Station, Durham, New Hampshire

IF THE dairymen in the northeastern part of the United States had all the clover and alfalfa hay they needed, their minds would be easier on two matters at least. First, and foremost, is the need just now for more milk. With the kind of hay they have this year and with a very short crop due to the drought of 1941, a good many dairymen are feeding a grain-milk ratio narrower than one pound of grain to three of milk. With plenty of legume hay, it wouldn't be necessary to feed so much grain and later on run the risk of mastitis, udder troubles, and possibly other ills to which the dairy cow is subject.

Then there is a nitrogen shortage in prospect, particularly of nitrates. This may be only temporary. New manufacturing establishments now under construction may be able to produce synthetically all the nitrogen that we need for our expanding war machine as well as our huge farm effort. Anyway, just now there seems to be a shortage of nitrates and their use will have to be curtailed somewhat this year in spite of the urge for greater production on the farmers' part.

Farmers have been synthesizing nitrogen on their farms for quite a while. The only trouble is, they don't do quite enough of it. They do not raise a large enough percentage of legumes to maintain the nitrogen income and outgo in proper balance in their hay and pasture fields. Maybe that is their fault and maybe it isn't. Perhaps we are all to blame for not finding a perennial leg-

ume that would fit into their long rotations, or for not working out a suitable scheme of fertilization that would keep a bigger percentage of legumes, clover, alfalfa, or whatnot in these hayfields.

At least we have a long rotation as an excuse. In fact, not many farmers in the Northeast have a cut and dried rotation system, in which a field is left in hay just so long, no matter. On the other hand, fields are usually left in hay crops as long as they will cut a satisfactory tonnage, regardless of whether there is any clover or alfalfa there.

In justification for these long rotations it should be pointed out that plowing is never as easily done here as it is farther west where the fields are larger and more level. A good deal of the land is tipped up "on edge" and with much tillage is easily susceptible to erosion. Hay and pasture are the principal crops on the dairy farm, and most dairy herds are so large that the farmer is hard pressed to produce the hay, pasture, and silage that his herd will eat during the season.

Too often the emphasis has been placed on tonnage or bulk rather than on the quality of the roughage produced, but in most cases hayfields are left as such for five, six, or eight years after seeding, long after the legumes that were included in the mixture have disappeared.

With such a system of crop rotation, a perennial legume is a godsend. Alfalfa is used by some farmers with good success. Unfortunately the soils have a high lime requirement which makes a seeding costly, and because of hardpan or lack of under drainage many of the soils will not hold alfalfa long. Ladino clover is coming into prominence, serves its purpose well, and will be used more widely when seed costs are lower, Even though alfalfa and ladino are available, most dairymen place their trust in red clover, or red and alsike, and these clovers ordinarily behave as biennials. The result is that after the second hay year the clover in most cases has practically disappeared from the hayfields, leaving only the grasses that were seeded, and we need clovers, in profusion, to counteract the nitrogen shortage and to give quality to the hay.

Every farmer recognizes the value of clover, both as a feed and as a source of nitrogen. But we may have been placing too much emphasis on it in

Single plot yields, showing comparisons, first cutting 1939. Check plot on left, phosphorus center, and potash right.

our long rotations for the conditions under which we have been farming. Perhaps we haven't grown enough of the perennials, alfalfa and ladino. Or maybe we haven't studied sufficiently the needs of our soils so that by modifying them red clover will persist longer than two years.

Plant breeders in Wales have developed a strain of red clover that has persisted under favorable conditions for seven or eight years. Workers in other countries have brought out red clover strains with a perennial tendency. Work is under way at the moment in this country on a perennial red clover. Here in New Hampshire in our red clover breeding work we have held individual plants through three full seasons without any special soil treatment.

Why Red Clover?

Why all this effort on red clover? Well, it is a rugged plant, easy to grow, bulky in yield and, of course, an excellent cow hay. It will grow on soils too wet for alfalfa to persist long and its lime and fertility requirements aren't quite so high as those of alfalfa. Dean C. E. Ladd of Cornell University stated at the Pennsylvania State Grassland Conference in 1940 that a triennial red clover would be worth a million dollars annually to the farmers of New York State. If we could only make it live one more year!

That we will undoubtedly be able to do. Breeding for the perennial tendency certainly offers great promise. But while the plant breeders are studying the chromosomes and making their crosses, all of which take time, let's take a tip from an experiment which has been in progress near Claremont, New Hampshire, for the last five years and make the soil conditions right so that clover will stay in, even while the plant breeders are doing their stuff.

Here is the gist of that experiment. A seeding of red and alsike clovers and timothy was made in August 1937 on a field situated on a terrace of the Connecticut River Valley. The field had been in plots which were continued. Some of the plots had received and continued to get an annual application of superphosphate or potash, and others both. Still others had other treatments including lime and complete fertilizers.

No harvest was made in 1937, but hay has been cut every year since. In 1938 there was a good crop on all the plots, mostly clover. By 1939, clover had almost disappeared from all plots except those which had received potash, but in 1940 and 1941 red clover persisted on the potash plots, with not only tremendous increases in yield but in quality too, of course. But it persisted only on the plots which had received potash, and it didn't matter what else they got.

Lime had no influence on clover persistence and, on this soil, very little effect upon yields. Superphosphate used alone didn't hold the clover nor did it increase yields appreciably. But potash held the clover there and practically doubled the yield over the untreated plots. When phosphate and potash were used together or in combination with nitrogen, the yields went to town. The potash had held something in the stand that responded—clover.

I do not mean to leave the impression that the clover was a full stand. But it was there in amounts sufficient to make good mixed hay on all the potash-treated plots. The question naturally arises, were these perennial plants of red clover or did dormant seeds lying in the soil germinate and grow? They didn't come from manure, since manure was not used as a top-dressing and none had been applied since 1936, the year before the seeding was made. Of course, we'd like to know whether they were perennials and we are studying them in our nursery. But from the farmer's point of view, it doesn't matter whether they were biennials or perennials, the feed is just as good from one type as it is from another. What we do know is that it wasn't a perennial on any of the plots that didn't get potash.

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Legumes Will Furnish Needed Nitrogen

By R. Y. Bailey

Chief, Agronomy Division, Southeastern Region, Soil Conservation Service, Spartanburg, South Carolina

PRODUCTION for war needs is probably the most generally discussed topic in the country today. Although food and fiber crops are not as spectacular as the planes, tanks, and guns that are coming from the assembly lines, they are just as essential to the successful prosecution of the war.

One of the most important of the problems in production is that of providing adequate supplies of nitrogen to meet the needs of both industry and agriculture. A shortage of nitrogenous fertilizer will be particularly serious in the South where most of the soils are deficient in nitrogen. Since most of the commercial supply is likely to be needed in the manufacture of munitions, it will probably be necessary for a large part of the nitrogen required in agriculture to be derived from legumes.

Legumes for Nitrogen

Fortunately, state agricultural experiment stations have studied the possibilities of growing legumes in cropping systems to supply nitrogen for the production of other crops. Information derived from these studies is of unusual importance to the Nation as a whole at this time. It is entirely probable that through the application of the findings of these institutions Southern farmers may be able to produce adequate supplies of certain vital crops, of which there might otherwise be serious shortages.

Results of experiments with legumes have shown that it is possible to produce large yields of other crops with nitrogen from legumes grown in rotations and plowed into the soil. Because of the abundance and relatively low price of commercial sources of nitrogen, farmers have not made as general use of legumes as they are likely to find it necessary to do during the war period.

Much emphasis has been placed on experiments with winter legumes such as the vetches, winter peas, and clovers, either alone or in combination with small grains and grasses. Yields of crops following winter legumes turned under have compared favorably with yields where liberal applications of commercial sources of nitrogen or barnyard manure have been used.

For example, on Tifton sandy loam at the Georgia Coastal Plain Experiment Station a 9-year average yield of 740 pounds of seed cotton per acre was made without nitrogen, compared with 1,316, 1,206 and 1,168 pounds following crops of Austrian winter peas, Monantha vetch, and hairy vetch, respectively.

At Knoxville, Tennessee, corn grown on Cumberland loam, without legumes in the cropping system, made a 4-year average yield of 30.8 bushels per acre, compared with 43.4 bushels where crimson clover was turned under. Many other similar examples could be cited.

In addition to the direct benefit derived from turning under winter legumes, it has been shown by results at the Alabama and the Louisiana Agricultural Experiment Stations that there is a residual effect the second and third years after winter legumes are turned

under. On light sandy loam at St. Joseph, Louisiana, the residue from three crops of hairy vetch resulted in an increase of 195 and 399 pounds of seed cotton the second and third years, respectively, after vetch was turned under.

On Norfolk sandy loam at Auburn, Alabama, vetch was turned under about March 25, April 5, and April 15 during the three years 1925 to 1927, inclusive. The average yields of green vetch at the three dates of turning were 5,259, 8,849 and 12,072 pounds per acre. Corn was planted about 10 days after vetch was turned under and a companion plot planted on the same day was fertilized with 200 pounds of nitrate of soda per acre. In 1928, Monantha vetch was killed by cold, and as a result the yields that year represented a comparison of the residue from the three previous crops of vetch that were turned at early, medium, and late dates and the 200 pounds of nitrate of soda that were applied on each companion plot. The acre yields on the vetch plots were 16, 28.9, and 34.6 bushels, compared with 22.6, 22, and 25 bushels on companion plots where 200 pounds of nitrate of soda per acre were applied. The average yield of the four check plots that received no nitrogen was 9.5 bushels per acre.

Compare corn growing where no lespedeza was grown (above) with corn following Kobe lespedeza that was turned under (right).

The annual summer legumes have not been emphasized as much as have the winter legumes. Considerable work has been done with such summer annuals as cowpeas, soybeans, and crotalaria as interplanted crops with corn. Variations in dates, rates, and methods of seeding, and in seasonal conditions have resulted in such wide differences in the growth of interplanted summer legumes that the influence on yields of succeeding crops has been far less impressive than the effect of winter legumes. Where large yields of summer legumes have been turned under, yields of succeeding crops have been substantially increased.

Most of the summer legumes seeded after small grain crops have been considered as forage rather than soil-improving crops. As a result, the stubble of summer legumes has been returned to the soil, whereas, it has been common practice to turn the entire crop of many of the winter legumes under to supply nitrogen for succeeding crops.

Crotalaria is a summer legume that

cannot be used for hay and is, therefore, returned to the soil. Crotalaria has proved very effective as a soil-improving crop in Florida, in the sandhill section of the Carolinas, and on the sandy soils in the Coastal Plain section of other Southern states. It seems to make more satisfactory growth than most other legumes when interplanted with corn. It makes the major portion of its growth in the fall after corn matures. It is a good seed producer and volunteers for several years if a crop is produced and left on the land. Crotalaria has grown well when seeded on small grain in February or March. It is particularly promising on sandy soils where lespedeza sometimes fails during periods of spring drought when the grain crop is drawing heavily on soil moisture, or as a result of heavy infestations of nematodes. Crotalaria spectabilis is one of the most completely nematode-resistant crops grown in the Coastal Plain.

Lespedeza Deserves Attention

Annual lespedeza is the ugly duckling of the annual legumes in the South. This crop has probably received less attention in research than any other legume of major importance. Published results of experiments with lespedeza as a soil-improving crop are extremely limited. Wherever lespedeza has been included in soil fertility experiments and treated as a soil-improving rather than as a hay crop, it has given remarkable increases in the yields of succeeding crops. In six trials at the North Carolina Station, there was more than a 100% increase in the yields of crops following lespedeza.

Miller reported in Farmers' Bulletin 1724 that an average yield of corn on six fields in North Carolina, Kentucky, and Tennessee was 19.3 bushels per acre where no lespedeza was grown, compared with 41.1 bushels following lespedeza. He also reported an average increase of 317 pounds of lint cotton per acre following lespedeza on 10 farms in Tennessee and North Carolina.

E. C. McArthur, Gaffney, South Carolina, won the State 5-Acre Cotton Contest in 1941 with an acre yield of 1,140 pounds of lint on a field where Kobe lespedeza had been grown in the rotation. Lespedeza was turned in the fall of 1940 and followed by a mixture of barley and Austrian winter peas, which was grazed off during the winter and early spring. The stubble of the winter crop was turned under and cotton was fertilized with 600 pounds of 4-8-6, 120 pounds of nitrate of soda, and 80 pounds of muriate of potash per acre. Although the cotton was fertilized liberally, Mr. McArthur does not believe he could have obtained such a large yield if the land had not been in a high state of fertility as a result of growing lespedeza in the rotation.

Probably the strongest point in favor of lespedeza is its ability to produce an abundance of seed that can be either harvested for planting additional acreage or left for reseeding on the land where lespedeza is to be left for an additional year.

Interest in perennial legumes has developed rather slowly in the South. Both kudzu and lespedeza sericea are hardy, deep-rooted perennials that have shown ability to grow on a wide variety of soils. They have grown well on poor, eroded soils, with less liming and fertilizer treatment than is required by most other legumes. Although information about their value for soil improvement is limited, results to date have been most encouraging.

A 3-year-old stand of kudzu at Auburn, Alabama, was plowed up in the spring of 1919 and followed by other crops. Yields of both sorghum hay and corn were approximately twice as large over a period of several years as were the yields on an adjoining plot where kudzu was not grown. There was a substantial increase in the yield of oats on the kudzu plot. Results of this experiment were published but did not create sufficient interest to stimulate the use of kudzu on an extensive scale.

Further studies that were made by

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Above: This Mississippi farm boy is helping his father harvest 270 bushels of bur clover seed, worth $135, from six-tenths of an acre.

Below: A yield of 40 bushels of corn per acre following kudzu near Dadeville, Alabama. The kudzu was mowed for hay and grazed for three years before it was plowed for corn.

Above: This steep, eroded slope near Lineville, Alabama, was considered too poor for further cultivation when seeded to lespedeza sericea in 1936. It has been mowed for hay since 1937. Last year a strip planted to corn yielded 53 bushels per acre.

Below: Austrian winter peas on Orangeburg sandy loam in Escambia County, Florida, furnished enough nitrogen for the row crop that followed after peas were turned under.

Above: Clovers grown in a mixture with grasses in a rotation arranged in strips on this sloping Virginia farm are supplying nitrogen for corn and also reducing the amount of soil lost through erosion.

Below: Crotalaria seeded on oats in March near Gainesville, Georgia, produced a large crop of seed and will supply nitrogen for the next crop. It also furnished excellent protection against erosion.

Above: This home-made seed pan does not save as large a percentage of the seed as a combine, but it enables this Alabama farmer to harvest enough lespedeza seed for his own use.

Below: This Alabama farmer wanted crimson clover seed, and found a way to harvest enough for the needs of his small farm.

The Editors Talk

Legumes—Front!

Fast being called to the front of major war crops, legumes are beginning to share the publicity and emphasis given the food and oil-producing crops in American agriculture's all-out war effort. The shortage of nitrogenous fertilizers this spring and the possibility that this shortage will become more acute as the war progresses have hastened this call, for legumes will grow the much needed nitrogen.

We feel fortunate in being able to present in this issue two articles on growing legumes—one from the South and one from the North. In his article, R. Y. Bailey, Chief, Agronomy Division of the Southeastern Region, Soil Conservation Service, not only outlines the possibilities of growing legumes in cropping systems to supply nitrogen for the production of other crops, but relates some of the many benefits to be derived from both winter and summer annual legumes in rebuilding soil fertility and checking erosion. "If we in the South take full advantage of the information that is available," says Mr. Bailey, "we can through the simple medium of legumes draw upon the inexhaustible store of atmospheric nitrogen. . . . We may thereby produce in abundance the food and fibre crops required in the struggle to restore order in the world, and in so doing build for ourselves a safer and more profitable post-war agriculture."

Mr. Bailey submitted so many good pictures to illustrate points in his article that our entire "Pictorial" section in this issue is devoted to their presentation.

Professor Ford Prince, Head of the Agronomy Department, University of New Hampshire, author of the article from the North, says, "If the dairymen in the northeastern part of the United States had all the clover and alfalfa hay they needed, their minds would be easier on two matters," and designates these "matters" as the need just now for more milk and the nitrogen shortage.

"Farmers have been synthesizing nitrogen on their farms for quite a while. The only trouble is, they don't do quite enough of it," Professor Prince declares. "They do not raise a large enough percentage of legumes to maintain the nitrogen income and outgo in proper balance in their hay and pasture fields." To substantiate what can be done, he details the results of an experiment begun in 1937 in the Connecticut River Valley where clover persistence was maintained with the practical and profitable use of mineral fertilizers, particularly potash.

In concluding, Professor Prince says, "This seems to be a good time to let potash 'pinch-hit' for nitrogen by using more of it or taking better care of manure to grow more clovers. Farmers who find that their soils respond to potash, as this one does, and capitalize on that fact, will certainly be well repaid during the next few years by harvesting better hay with more clover in it and thereby adding to the nitrogen supply of the farm."

A rough calculation of the nitrogen situation shows how legumes can fit into this emergency. It is estimated that due to the reduced importations of nitrate of soda and cyanamid and the complete diversion of ammonia liquors and con-

centrated nitrogen synthetic materials there may be a nitrogen deficit of 160,000 tons during the coming year. Data at numerous experiment stations show that legume green manures can furnish the equivalent of 15 to 100 pounds or more nitrogen per acre. If an average figure of 30 pounds per acre is taken, it would require only 10,700,000 acres of legumes to supply 320,000,000 pounds of nitrogen which may be lacking in fertilizers the coming year.

In the South, much of this can be supplied by winter cover legumes; and in the North, by the aftermath in legume meadows. Thus only a part of this acreage would have to be taken out of crop production during the year in order to fully meet the requirements. This would appear to be a practical solution to the possible nitrogen shortage during the next year or two.

The One-Year Rotation

Rotation vs. the one-crop or cash-crop system of farming has long been a subject of extension education. The relative merits of three- and four-year rotations are well established and quite generally known. Now comes a feasible one-year rotation. The possibility of growing a grain crop, having a legume pasture, and a winter cover on the same field year after year for as many years as desired is explained in a new Missouri Experiment Station bulletin, No. 439, "Growing Good Crops of Oats in Missouri," by J. M. Poehlman. Based on experimental work, it has been shown that lespedeza can be sown in oats or oats can be sown on old lespedeza sod by disking. When the oats are cut, the lespedeza will come along for a summer pasture and the dead plants will act as a fairly good cover over the winter. Enough volunteer lespedeza will appear the next year to establish a good stand, and oats can be planted again by disking the old sod, thus completing a rotation in one year. Barley can be used in the place of oats.

A large annual return per acre, produced at a low cost, is the most conspicuous feature of the small grain-lespedeza rotation. If the grain crop is at least moderately treated with fertilizer and the lespedeza is pastured down, adding nitrogen and organic matter to the soil, the fertility will be improved rather than reduced, notwithstanding the heavy production.

Many people consider small grain and lespedeza as crops not needing fertilization, but there is important evidence from work in Missouri and other places that both of these crops will respond to fertilization under many conditions and will be better feeds if well fertilized. The legume crops are not efficient nitrogen fixers if they are not well supplied with mineral nutrients. In a rotation of the type mentioned, it therefore would be necessary to provide adequate lime, phosphate, and potash if the fertility of the soil is to be maintained and high yields and good quality forage obtained year after year.

It is readily seen that one of the great advantages of this type of one-year rotation is the saving of time and labor in plowing, since only disking is needed each spring to prepare the seedbed. Losses from soil erosion undoubtedly would be held to a minimum, thus making it an important soil conservation practice.

An abundance of winter feed and summer forage would be produced with low harvest labor requirements, and soil fertility would be maintained and even improved. There probably would be some problems to be worked out in a wide adaptation of such a rotation, yet the possibilities offered make it worth serious consideration, and trial in those areas where lepedeza can be grown.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ Several additional pamphlets dealing with fertilizer statistics have been received during the month. One is from New York, Mimeographed Pamphlet 663 of the Agronomy Department of Cornell University, compiled by E. L. Worthen. This shows that the total fertilizer tonnage for 1941 was substantially higher than that of the last four years with almost 60% of the tonnage in the form of mixed goods, the other 40% consisting mostly of phosphates with some nitrogenous materials and still less straight potash salts. About 80% of the fertilizer contained 20 or more units of plant-food. There were 104 different analyses sold, 3 less than the year before, which as Dr. Worthen points out does not indicate a rapid progress in the reduction of the number of fertilizer grades offered for sale in the State. Over 80% of the mixed goods offered for sale, however, were included in the 12 leading analyses, 7 of which were grades approved by the Experiment Station. The two leading grades were 5-10-5 and 4-8-8.

Earl Jones of the Agronomy Department, Ohio State University compiled figures for his State in 1941. The total fertilizer tonnage for Ohio was just a little higher than that in New York, and in 1941 was much higher than any year back to 1930. Over this period nitrogen increased more than 3,000 tons, phosphoric acid more than 5,000 tons, potash more than 12,000 tons, the latter almost double that in 1930. About 97% of the tonnage was in the form of mixed fertilizers, the straight material sold consisting mostly of phosphates with some ammoniates and a small amount of potash salts. Most of the fertilizers contained 20 or more units of plant food, while nearly three-quarters of all the fertilizers were included among the standard analyses or multiple strength analyses. The leading analysis was 2-12-6 which was far ahead of any other grade, and almost 54% of all the fertilizers sold in the State.

¶ Another publication dealing with fertilizer statistics is the Annual Fertilizer Report, issued as Bulletin 230, of the Wisconsin State Department of Agriculture. This was prepared by W. B. Griem and shows that 1941 had by far the highest fertilizer consumption in the State's history—84,120 tons. More than 80% of this tonnage consisted of mixed fertilizers, the remainder being mostly phosphates. Nearly all fertilizers contained 20 or more units of plant food. The 2-12-6 was by far the most popular grade of fertilizer, although the combination of the 20% and 45% superphosphates would exceed this figure. The second most popular was the 3-12-12, this grade having shown a remarkable increase in popularity over the last 15 years.

"Commercial Fertilizers, 1941," Agr. Exp. Sta., Orono, Maine, Off. Insp. 181, Oct. 1941, Elmer R. Tobey.

"Rules and Regulations Governing Commercial Fertilizers," St. Dept. of Agr., Lansing, Mich.

"Soil Fertility Experiments with Cotton,

Hemphill Field," Agr. Exp. Sta., State College, Miss., Serv. Sheet 327, Jan. 1942, Roy Kuykendall.

"Commercial Fertilizers and Winter Legumes for Cotton Production, Gary Field, Tallahatchie River Soil," Serv. Sheet 328, Jan. 1942, Roy Kuykendall.

"Soil Fertility Experiment with Cotton, Schaefer Field, Yazoo River Soil in the Southeast Delta," Agr. Exp. Sta., State College, Miss., Serv. Sheet 329, Jan. 1942, Roy Kuykendall.

"Growth and Composition of the Strawberry Plant as Affected by Source of Nitrogen and pH Value of the Nutrient Medium," Agr. Exp. Sta., New Brunswick, N. J., Bul. 691, Dec. 1941, J. Harold Clark.

"Fertilizer Tonnage for New York, 1941," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Mimeo. 663, Apr. 8, 1942, E. L. Worthen.

"Fertilizer Sales in Ohio, 1941," Agr. Ext. Serv., Columbus, Ohio.

"The Effect of Certain Nitrogenous Fertilizers on the Chemical and Vegetative Composition and Yield of Pasture Plants," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 75, Nov. 1941, J. F. Eheart and W. B. Ellett.

"Surface Run-off and Erosion from Permanent Pastures in Southwest Virginia as Influenced by Applications of Triple Superphosphate," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 77, Dec. 1941, W. H. Dickerson, Jr., and H. T. Rogers.

"Effect of Fertilizer Placement on Yields of Peas Used for Frozen Pack in Western Washington," West. Wash. Exp. Sta., Puyallup, Wash., Mimeo. Cir. 108, Jan. 1942, Karl Baur and G. A. Cumings.

"Commercial Fertilizers, 1942," St. Dept. of Agr., Madison, Wis., Bul. 230, May 1942.

"What Fertilizers for Canning Peas?" Agr. Ext. Serv., Madison, Wis., C. J. Chapman and H. H. Hull.

"Soil Fertilization and Management in 1942 in the 'Food for Victory' Program," Agr. Ext. Serv., Madison, Wis., Jan. 15, 1942.

"What Kind of Lime Shall I Use?" Agr. Ext. Serv., Madison, Wis., C. J. Chapman and Emil Truog.

"1942 Suggestions for Fertilizers for Various Crops on Sandy Soils," Agr. Ext. Serv., Madison, Wis., A. R. Albert.

"1942 Suggestions for Fertilization of Various Crops on Peat or Muck Soils," Agr. Ext. Serv., Madison, Wis., A. R. Albert.

Soils

¶ A rather detailed chemical study of 57 soil samples taken from pastures in various parts of Virginia has been made by M. O. Price, W. B. Ellett, and H. H. Hill, who have published their findings in Virginia Agricultural Experiment Station Technical Bulletin 78, "Pasture Production as Affected by Type and Chemical Composition of the Soil." For each sample, acidity, carbon, total and available nutrients, exchangeable bases, exchange capacity, base saturation, and the condition of the pasture are recorded. The good pastures tended to be higher in total and available phosphoric acid and exchangeable potash, and had a higher exchange capacity and a higher percentage base saturation than poor pastures. Total potash, however, did not correlate with condition of the pasture.

¶ "Soil Conservation in Indiana" by R. O. Cole, Purdue University Agricultural Extension Bulletin 128, revised, covers the subject in a practical and non-technical manner. The bad effects of erosion are clearly brought out and methods for controlling it are explained. The author has kept in mind the important fact that farmers have to make a living off their land and that soil conservation, while very important in the long run, must be adapted to the problem of making a profit from farming this year as well as 10 years from now. He shows how farmers can conserve their soils and grow a better crop in the present and also in the future.

¶ Two very useful special circulars on the management of soils have been issued by the Wisconsin Agricultural Extension Service. One of these is "Central Wisconsin Heavy Soils" by A. R. Albert and his co-workers at the Marshfield Branch Experiment Station. The other is "How to Manage Sandy Soil" by A. R. Albert. Both of these circulars contain practical information for farmers on how to manage, crop, lime, and fertilize their soils. The practices vary considerably on the two groups of soils.

On the heavy soils proper drainage must be provided and at the same time surface erosion must be controlled. Lime must be applied as needed, this being determined by the acidity of the soil and the crops to be grown. The kind and variety of crop selected should be adapted to the soil on which it is

being grown and at the same time provide diversification and profitable returns to the farmer. It is suggested that legumes be grown on one-third to one-half of the plowed land since these provide high-quality feed and obtain nitrogen from the air. It is strongly suggested that the soil be tested for its lime requirement and also for its fertilizer needs.

As a general guide on the fertilization of the crop, 0-20-10 and 0-20-20 are suggested for grain and hay seedings with the rate of application 150 to 250 pounds per acre; for peas 0-20-20 or 0-20-10 at 175 to 200 pounds per acre if the preceding crop was a legume, otherwise 3-12-12, 3-18-9, or 2-12-6; while for soybeans the 0-20-10 and 0-20-20 are suggested. On the grass pastures and meadows a part of the area might well receive 200 to 300 pounds per acre of a quickly acting nitrogen fertilizer in the spring so as to produce some early pasturage. Nitrogen fertilizer should not be used on legume meadows. For corn 3-12-12, 3-18-9 or 2-12-6, at 75 to 200 pounds per acre depending on the method of application, is recommended. It is brought out that this small amount of fertilizer supplies only a part of the nutrient needs of the crop. The corn must obtain the major part of its nutrients from the fertility built up in the soil during a well-managed rotation.

On sandy soils the plow should be used sparingly. This can be accomplished by having a longer rotation with proper steps taken to establish alfalfa stands that are kept in for a number of years and by the use of the disk harrow for some of the operations. The diversification of crops is very important since in years of low rainfall a failure of some of the crops must be anticipated. Steps should be taken to reduce wind erosion by the use of windbreaks and by keeping the soil rough and covered. The author points out that sandy soils usually are not high in fertility to begin with and this is often still further reduced by improper management. Sandy soils frequently must have lime, phosphate, and potash added, with provision made to supply organic matter. Sometimes nitrogen also should be applied.

Great stress is laid on the growing of legumes, for which lime, phosphate, and potash are recommended. A legume may be grown in rye as a nurse crop, using about 250 pounds of 0-9-27 or 0-20-20. The alfalfa should be topdressed every 2 years with 200 to 500 pounds of 0-9-27. For soybeans 175 to 200 pounds per acre of 0-15-30 or 0-20-20 are recommended, with the caution given that the fertilizer should not be applied with the seed. For rye alone nitrogen along with phosphate and potash is beneficial. The equivalent of a 13-7-9 at the rate of 300 pounds per acre is used for this crop. For most of the vegetable crops and for corn in hills 3-12-12 is recommended. While the information in the two circulars was prepared primarily for Wisconsin farmers, all farmers living in the northern states can well consider the principles set forth and will find much information that can be applied to their own conditions.

"Soil Conservation in Indiana," Agr. Ext. Serv., Lafayette, Ind., Bul. 228, Jan. 1942, R. O. Cole.

"Soil Defense in Oklahoma, A Bibliography of Soil Conservation Publications," Agr. Exp. Sta., Stillwater, Okla., Cir. C-97, Apr. 1942, Kathryn Drake.

"Pasture Production as Affected by Type and Chemical Composition of the Soil," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 78, Dec. 1941, N. O. Price, W. B. Ellett, and H. H. Hill.

"Erosion and Related Land Use Conditions on the Box Elder Creek Project, Nebraska," U. S. D. A., Washington, D. C., Erosion Survey 22, 1941, H. C. Mortlock and R. D. Greenawalt.

Crops

¶ The agricultural program for the coming year calls for a large increase in canning crops, particularly tomatoes and peas. In order to help fulfill the goal set up under this program, Maryland, one of the most important canning States in the country, has issued pamphlets dealing with each of these crops. Popular Bulletin 1, of the Agri-

cultural Experiment Station, "Greater Production of Tomatoes for Canning," by C. H. Mahoney and H. A. Hunter gives practical information on the growing of this crop. The types of soil best suited for tomatoes, where they should be grown in the rotation, the liming and fertilization of the crop on different soils, varieties, planting, transplanting, cultivation, and disease control all are briefly covered.

"Growing Peas for Canning," Extension Mimeograph No. 23, of the Maryland Extension Service and by the same authors, furnishes the same general type of information for peas. A similar type of publication on tomatoes is Oklahoma Experiment Station Miscellaneous Publication 5, "Production of Tomatoes for Canning in Oklahoma," by H. B. Cordner.

¶ The question of when and how to cultivate cotton has been investigated by the Mississippi Agricultural Experiment Station. The results of this work are reported in Technical Bulletin 29 of the Station, entitled "Weed Control and Cotton Tillage," by T. N. Jones, I. E. Hamblin and O. A. Leonard. They found that cotton had to be cultivated in order to control weeds, but too frequent or too deep cultivation reduced yields. Too great an interval between cultivations allowed weeds to get such a start that cultivation had to be very deep and thorough in order to control the weeds, and this often tended to reduce yields. About every 10 or 12 days was found to be the most desirable frequency of cultivation and except for the first one or two times through, the cultivation should be rather shallow since many of the feed roots are near the surface. A good, deep seedbed favored deeper rooting of the cotton, and under this condition there was less likelihood of root damage during cultivation. Fall and winter preparation of the seedbed gave higher yields than spring preparation and it was found that seedbed preparation had more effect on yield than did cultivation. This work was done on what is known as the Black Belt soils of the State and the results are directly applicable to these conditions, but cotton growers on other soils might well consider the facts brought out in this work.

¶ Again this month there are a number of bulletins dealing with gardens. There are so many of these that it is not possible to review them in detail, but particular attention is called to "Victory Gardens," Washington Extension Service Bulletin 180, by J. C. Snyder, L. G. Smith, and G. J. Harrar. This is put out in two editions, one for the farm and one for the town. Practical information on locating the garden, preparation of the soil, fertilization, time of planting, amount to plant, and pest control are given. Large applications of well-composted manure are recommended, and if this is not available, such fertilizers as 3-10-7, 5-10-10, and 3-10-10 at the rate of 500 to 800 pounds per acre are recommended. A large section of the bulletin is devoted to quite detailed information and directions on pest control. The town edition gives much the same information but in abbreviated form with fertilizer recommendation, for example, based on 1,000 square feet rather than an acre, and the information on pest control is very much reduced. These, and the other pamphlets listed this month and last month, are to be recommended to those who contemplate growing gardens under the Victory Garden Program.

¶ A good practical circular on potatoes has been prepared by J. G. Milward entitled "Potato Growing in Wisconsin," Wisconsin Agricultural Extension Service Circular 325. Varieties adapted to the State, preparation of the seedbed, method of planting, fertilization, cultivation, insect and disease control, and harvesting are briefly covered. Seed cutting and treatment are given particular attention as is also fertilization. It is stated that popular fertilizers for growers on upland soils are 3-9-18 and

3-12-12, while muck soil should receive 0-9-27 when growing this crop.

¶ The greatly increased demand for oils as a result of interruption of imports and increased use due to war activities has led the Department of Agriculture to place a goal of about five million acres of peanuts for the coming year. This is about two and one-half times the acreage planted last year. Practically all this increase should be put in the oil-producing varieties if the goal is to be met. Such a large increase in acreage means that many farmers who grew very few or no peanuts in the past will probably make peanuts an important enterprise on their farms this year. To supply information needed by these newer growers and to help other growers increase their efficiency of production, a number of circulars on peanut growing have been prepared by experiment stations in the South. In the list this month are circulars from North Carolina, South Carolina, and two each from Georgia and Mississippi. All of these have been written to supply practical information for the grower and cover soil adaptation, lime requirement, varieties, planting, fertilizing, cultivation, diseases, harvesting and curing.

There probably is no crop grown in the country on which there is such diversity of opinion as to proper fertilization. Experimental data on response of the crop to fertilizers also are confusing. As a result almost every type of conceivable fertilization is practiced and some practices almost approach the inconceivable. Out of the information at hand, however, it would appear as though there can be general agreement on a number of factors which should help in determining the proper fertilization. There seems to be but little doubt that peanuts have a high calcium requirement. In most sections this is met by applying ground limestone or some other lime material; in other sections gypsum or land plaster is rather commonly used. Many investigators have found that when peanuts are grown in a rotation of crops that are generously fertilized, the peanuts themselves do not respond so much to fertilization. This is particularly true so far as yield is concerned, although the quality even under these conditions is likely to be better if fertilizer is applied to the peanuts. There is also general agreement that peanuts make a heavy drain on the fertility of the soil, especially if the nuts are grown for oil and the hay is fed. Thus crops following peanuts frequently do poorly unless the peanuts are well fertilized. Under these conditions a fertilizer high in phosphate and potash is advisable and little or no nitrogen may be needed. When peanuts are grown in a rotation in which the previous crop was not well fertilized, the peanuts themselves usually respond to fertilization. On moderately fertile soil a phosphate-potash combination may be satisfactory although on poor soil some nitrogen fertilizer also is recommended.

¶ Soybeans also are receiving attention as an oil-producing crop. To supply information on the growing of this crop, Extension Circular 256 has been issued by the North Carolina Agricultural Extension Service. This was prepared by J. A. Rigney and E. R. Collins and is entitled "Growing Soybeans in North Carolina." For the fertilization of soybeans on Coastal Plains soils it is recommended that 200 to 300 pounds of fertilizer such as 0-8-8, 2-10-6, and 0-8-16 be used on soils with medium to high fertility, while on soils with lower fertility 2-10-6, 3-8-6, 3-12-6, or 2-8-10 should be used. On the Piedmont and mountain soils 0-10-6, 2-10-6 and 3-12-6 are recommended.

¶ As a part of its contribution to the war effort of the country, our agriculture has been called upon to furnish greatly increased amounts of dairy products during the coming year. Obviously only a small part of this increase can come from new producing units, since a cow cannot be produced in six months. The answer to the

problem lies largely in more efficient handling of the livestock we already have so that they will produce more. Probably the most important single item in increasing the efficiency of livestock production is improvement in pasture utilization. It has been shown time and again that a well-managed pasture will produce high quality feed at the lowest cost and with the least expenditure of labor. How pastures can be better utilized either by improving those already established or by making new pastures is shown in a very interesting and significant publication, "Pasture Culture in Massachusetts," by W. G. Colby, Massachusetts Agricultural Experiment Station Bulletin 380. A great deal of background material is given by the author so that present practices and reasons for them can be better understood. The soils are first considered from the viewpoint of their origin, formation, and early treatment. It is brought out that Massachusetts soils do not have the large reserves of natural fertility that soils in some other sections possess. They naturally tend to be acid in reaction, and are deficient in nitrogen, calcium, potassium, magnesium, and to a lesser degree in phosphorus. While the soils may not be naturally overfertile, with proper handling they can be made very productive.

The early settlers found that the initial productiveness of the soil soon decreased. Sometimes they would seek out other soils, but as the settlements became more densely populated other measures had to be employed. These involved the use of manure and certain other fertilizer materials or amendments, particularly wood ashes and gypsum, with occasionally bone fertilizer and guano being used. These treatments usually were given to the more intensely cultivated areas, with little or no attention being paid to grasslands. The constant pasturing and removal of the fertility of the grasslands tended to lower their productiveness so that fewer animals could be maintained. This resulted in less manure being produced so that there usually was never any left over for application to pasture land. The constant transference of fertility from the pasture to the plowed areas accelerated depletion of fertility of the pastures. A few early and very successful attempts at pasture improvement by some outstanding farmers were reported, but in general there was little attention given to improving grassland.

With present-day knowledge of how to improve pastures and with fertilizer materials available, there is little excuse for such large areas of unproductive pastures as still exist. The author points out that the secret of successful production on pastures or anywhere else is having all factors necessary for high production provided in proper balance to each other. First of all, if the soil is too thin and too poor to support a good growth, no attempt should be made to pasture it at all. Such lands should revert to forests. Thus a pasture should be tillable and the author brings out that the old type of permanent pasture is largely a thing of the past, or at least it should be under efficient management. The modern pasture should be of a semi-permanent type, land which will be in pasture for a number of years and then plowed and reseeded to pasture or seeded to other crops for a year or two. Such a system permits a closer control of the type of plant in the pasture so as to maintain a sod composed of the more desirable forage plants.

Proper attention must be paid to improving the soil with treatments as needed. Usually lime in amounts sufficient to correct soil acidity and provide available calcium is the first thing needed. Potash is usually the next limiting element in Massachusetts, but phosphate also is needed so that after lime, a phosphate-potash fertilization should be applied. On some infertile soils, nitrogen also will be needed to get the pasture started although when soil has been properly built up and a good sod established, the nitrogen should be supplied by the legumes in

the pasture. More recently other nutrients, particularly boron and magnesium, are likely to be needed on many of the soils, especially if some of the more desirable legumes are to be grown. Top-dressing with lime, phosphate, and potash is recommended in order to maintain the fertility of the pastures and promote the growth of desirable forage plants. Good seed mixtures and the management of the grazing so as to utilize the forage produced also are discussed by the author.

"Better Farming in 1942," Agr. Ext. Serv., Auburn, Ala., Cir. 225, Feb. 1942.

"Cooperative Potato Projects in Ontario; Progress Report 1941," Ont. Dept. of Agr., Ottawa, Canada.

"Soybeans for Delaware Farms," Agr. Ext. Serv., Newark, Del., Mimeo Cir. 14, Feb. 1942, C. E. Phillips.

"Ground Covers for Florida Gardens," Agr. Exp. Sta., Gainesville, Fla., Bul. 364, Nov. 1941, J. M. Crevasse, Jr.

"Some Analytical Studies of the Perisian Lime," Agr. Exp. Sta., Gainesville, Fla., Tech. Bul. 368, Feb. 1942, S. J. Lynch.

"Factors Affecting Peach Tree Longevity in Georgia," Agr. Exp. Sta., Experiment, Ga., Bul. 219, Mar. 1942, E. F. Savage and F. F. Cowart.

"Peanut Culture in Georgia," Agr. Ext. Serv., Athens, Ga., Bul. 490, Feb. 1942, E. D. Alexander.

"Peanut Production in the Coastal Plain Area of Georgia," Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper 9, Feb. 1, 1942.

"Establishing Bermudagrass," Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper 10, Feb. 1, 1942.

"Soybeans," Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper 11, Feb. 15, 1942.

"Home Garden for the Coastal Plain of Georgia," Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper 12, Mar. 5, 1942.

"Growing Lettuce from Seedlings," Agr. Ext. Serv., Honolulu, T. H., Cir. 143, Jan. 1942, Ashley C. Browne.

"Ten Points on Potato Growing," Agr. Ext. Serv., Urbana, Ill., Ve-2, Jan. 1942, Lee A. Somers.

"Spring Oat Varieties for Illinois," Agr. Exp. Sta., Urbana, Ill., Bul. 481, Jan. 1942, George H. Dungan, O. T. Bonnett, and W. L. Burlison.

"Illinois Corn Performance Tests, 1941," Agr. Exp. Sta., Urbana, Ill., Bul. 482, Feb. 1942, R. R. Copper, G. H. Dungan, A. L. Lang, J. H. Bigger, Benjamin Koehler, and Oren Bolin.

"Spring Wheat—Adaptability for Illinois," Agr. Exp. Sta., Urbana, Ill., Bul. 483, Feb. 1942, G. H. Dungan and W. L. Burlison.

"Spring Barley," Agr. Exp. Sta., Urbana, Ill., Bul. 485, Apr. 1942, G. H. Dungan and W. L. Burlison.

"Growing Fruit for Home Use," Agr. Ext. Serv., Urbana, Ill., Cir. 524, Mar. 1942, Victor W. Kelley.

"Pasture for Cheap Gains and Healthy Hogs," Agr. Ext. Serv., Lafayette, Ind., Leaf. 226, M. O. Pence and C. M. Vestal.

"A Study of Some Factors Affecting the Yield and Market Value of Peppermint Oil," Agr. Exp. Sta., Lafayette, Ind., Bul. 461, June 1941, N. K. Ellis, K. I. Fawcett, F. C. Gaylord, and L. H. Baldinger.

"Forage Sorghums for Indiana," Agr. Exp. Sta., Lafayette, Ind., Agron. Mimeo. 15, Rev. Dec. 1941, R. R. Mulvey.

"1941 Report of the Muscatine Island Field Station," Agr. Ext. Serv., Ames, Iowa, FG-558, Victor E. Hollar.

"Kansas Corn Tests, 1941," Agr. Exp. Sta., Manhattan, Kans., Bul. 299, Jan. 1942, A. L. Clapp, R. W. Jugenheimer, H. D. Hollembeak, and J. H. Lonnquist.

"Korean Lespedeza in Kansas," Agr. Exp. Sta., Manhattan, Kans., Cir. 210, Dec. 1941, Kling L. Anderson.

"The Hot Water Treatment of Sugarcane," Agr. Exp. Sta., University, La., Bul. 336, Feb. 1942, C. W. Edgerton, I. L. Forbes, P. J. Mills, Jean Dufrenoy, and W. J. Luke.

"Report of Progress for Year Ending June 30, 1941," Agr. Exp. Sta., Orono, Maine, Bul. 405, June 1941.

"Greater Production of Tomatoes for Canning," Agr. Exp. Sta., College Park, Md., Pop. Bul. 1, Apr. 1942, C. H. Mahoney and H. A. Hunter.

"Growing Peas for Canning," Agr. Ext. Serv., College Park, Md., Mimeo. 23, Apr. 1942, C. H. Mahoney and H. A. Hunter.

"Highlights of the Work of the Mississippi Experiment Station—Fifty-fourth Annual Report for the Fiscal Year Ending June 30, 1941," Agr. Exp. Sta., State College, Miss.

"Weed Control and Cotton Tillage," Agr. Exp. Sta., State College, Miss., Tech. Bul. 29, Dec. 1941, T. N. Jones, I. E. Hamblin, and O. A. Leonard.

"Mississippi's Food for Freedom Goal 1: 130,000 Acres of Peanuts for Oil," Agr. Ext. Serv., State College, Miss., Cir. 1, Feb. 1942, J. M. Weeks and J. F. O'Kelly.

"Mississippi's Food for Freedom Goal 2: 250,000 Acres of Soybeans for Grain," Agr. Ext. Serv., State College, Miss., Cir. 2, Feb. 1942, J. F. O'Kelly and J. M. Weeks.

"Peanuts for Victory," Agr. Ext. Serv., State College, Miss., J. M. Weeks.

"Selecting Fruit Varieties," Agr. Exp. Sta., Columbia, Mo., Bul. 437, Nov. 1941, T. J. Talbert and A. D. Hibbard.

"Growing Good Crops of Oats in Missouri," Agr. Exp. Sta., Columbia, Mo., Bul. 439, Jan. 1942, J. M. Poehlman.

"Varieties of Vegetables for 1942," Cornell Univ. Agr. Ext. Serv., Bul. 476, Feb. 1942, Paul Work.

"Peanut Production in North Carolina," Agr. Ext. Serv., Raleigh, N. C., Cir. 257, Apr. 1942.

"Tomatoes for Oklahoma Gardens," Agr. Exp. Sta., Stillwater, Okla., Cir. C-98, Mar. 1942, H. B. Cordner.

"Better Wheat for Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Cir. C-99, Mar. 1942, Horace S. Smith.

"1941 Report, Cotton Variety Tests in Oklahoma," Agr. Exp. Sta., Stillwater, Okla., MP-4, Apr. 1942, H. E. Dunlavy, I. M. Parrott, F. W. Self, and E. Hixson.

"Production of Tomatoes for Canning in Oklahoma," Agr. Exp. Sta., Stillwater, Okla., MP-5, Mar. 1942, H. B. Cordner.

"Legume Silage in Dairy Feeding," Agr. Exp. Sta., State College, Pa., Bul. 411, Apr. 1941, S. I. Bechdel, R. W. Stone, P. S. Williams, and F. R. Murdock.

"Peanuts for Victory," Agr. Ext. Serv., Clemson, S. C., Cir. 203, Jan. 1942, H. A. Woodle.

"The Cotton Contest—1941; for Better Yield and Staple Value," Agr. Ext. Serv., Clemson, S. C., Cir. 205, Feb. 1942.

"The Corn Contest—1941," Agr. Ext. Serv., Clemson, S. C., Cir. 206, Mar. 1942.

"The Virginia Farm Victory Garden," Agr. Ext. Serv., Blacksburg, Va., Cir. E-356.

"Fiber Flax in Western Washington," Agr. Exp. Sta., Pullman, Wash., Pop. Bul. 166, Mar. 1942, E. G. Schafer.

"Fifty-first Annual Report for the Fiscal Year Ended June 30, 1941," Agr. Exp. Sta., Pullman, Wash., Bul. 410, Dec. 1941.

"Lawns for Western Washington," Western Wash. Exp. Sta., Puyallup, Wash., Mimeo. Cir. 44, Apr. 1942, Maynard S. Grunder.

"Better Pastures—More Milk," Agr. Ext. Serv., Pullman, Wash., Ext. Cir. 42, Mar. 1942, Leonard Hegnauer.

"Victory Gardens," Agr. Ext. Serv., Pullman, Wash., Bul. 280, Farm and Town Editions.

"Washington 4-H Clubs Work for Victory," Agr. Ext. Serv., Pullman, Wash., 4-H Cir. 59, Mar. 1942, Charles T. Meenach.

"Pastures—West Virginia's Most Important Crop," Agr. Ext. Serv., Morgantown, W. Va.

"Planting Forest Trees," Agr. Ext. Serv., Morgantown, W. Va., Cir. 330, Mar. 1941, R. B. Smith and Jack Byers.

"4-H Progressive Farmer Project," Agr. Ext. Serv., Morgantown, W. Va., R. J. Friant.

"Potato Growing in Wisconsin," Agr. Ext. Serv., Madison, Wis., Cir. 325, Mar. 1942, James G. Milward.

"A Home Garden on Every Farm," Agr. Ext. Serv., Madison, Wis., Cir. 329, Jan. 1942, James G. Moore and O. B. Combs.

"Put Pastures to Work," Agr. Ext. Serv., Madison, Wis., Cir. 330, Feb. 1942, F. V. Burcalow and H. L. Ahlgren.

"Pastures Suggestions for April—Keep 'em Eating," Agr. Ext. Serv., Madison, Wis., H. R. Lathrope.

"Strawberry Culture, Western United States," U. S. D. A., Washington, D. C., Farmers' Bul. 1027, Rev. Nov. 1941, George M. Darrow and George F. Waldo.

"The City Home Garden," U. S. D. A., Washington, D. C., Farmers' Bul. 1044, Rev. Feb. 1942, W. R. Beattie.

"Growing Alfalfa," U. S. D. A., Washington, D. C., Farmers' Bul. 1722, Rev. Nov. 1941, H. L. Westover.

"Experiments with Annual Crops and Permanent Pastures to Provide Grazing for Dairy Cows in the Sandhill Region of the Southeast," U. S. D. A., Washington, D. C., Tech. Bul. 805, Nov. 1941, E. W. Faires, J. R. Dawson, J. P. LaMaster, and G. H. Wise.

"The Amazon Basin Brazil Nut Industry," U. S. D. A., Washington, D. C., For. Agr. Rept. 4, Jan. 1942, Walter R. Schreiber.

"Some Landmarks in the History of the Department of Agriculture," U. S. D. A., Washington, D. C., Agr. History Ser. 2, Jan. 1942, T. Swann Harding.

"The Naturalization of Roadbanks," U. S. D. A., Washington, D. C., Tech. Note 51, Feb. 1, 1942, C. R. Hursh.

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Economics

¶ The South Carolina Agricultural Experiment Station in cooperation with the U. S. Department of Agriculture, Bureau of Agricultural Economics, has recently published an interesting new Bulletin No. 339, "Attitudes of Edgefield County Farmers Toward Farm Practices and Rural Programs." The study is somewhat different from the usual type of social economic surveys in that it is an attempt to analyze the attitudes and values of farmers in relation to a selected group of agricultural programs and proposals. The study was conducted in Edgefield County because the farmer members of the County Agricultural Planning Committee had made a request for information that could be obtained only through field research. The field interviewing was begun in the fall of 1940, but the bulletin is based largely on the results of the work conducted during the spring and summer of 1941.

The success or failure of group programs, either Federal or State, depends largely upon farmer cooperation, and unless agricultural workers are informed with respect to farmer attitudes and the reasons for their thinking, the value of the work is likely to be severely lessened.

In this particular study the following 14 different programs were studied: Live-at-home, terracing, old-age assistance, school buses, conservation payments, winter cover crops, CCC programs, seed loans, cotton allotments, tenant loans, forest purchase, recreational programs, county agricultural planning, and transfer of cotton allotments.

In general the opinions of farmers were more definite on the issues which they understood best. For example, in the case of the live-at-home program 93.9% approved with only 5.5% neutral and only .6% disapproving. In the case of county agricultural planning, only 37.4% approved, whereas 52.2% were neutral and 10.4% disapproved. The approval of the different programs varied from 93.9% with respect to the live-at-home program down to 31.3% on the transfer of cotton allotments.

In the case of county agricultural planning, which produced the greatest number of undecided opinions, it appears that farmers are willing to give the committees a chance to see what they can do.

In this connection it is pointed out that since first impressions are likely to be lasting, it is important that the early proposals of such planning committees shall be of a type that will arouse the least controversy and enjoy most universal approval. It is essential that planning committees receive almost universal approval because in the future it can be expected that farmers will turn to such committees for leadership on problems concerning which there is a sharp difference of opinion as to the desirable course of action.

The conclusion with respect to demonstrations was particularly interesting. In this connection it is pointed out that demonstrations seem to lose some of their effectiveness if the farm on which the demonstration is located is considered by the neighboring farmers to represent a soil type different from their own or a combination of farm enterprises which they do not follow. It is particularly important that demonstrations not be located on farms considered by neighboring farmers to have any advantages over the existing conditions under which they are compelled to farm.

The authors have made many interesting comments with respect to approval or sound opposition with respect to the various programs. It should prove interesting reading to all those concerned with Southern agriculture.

"Avocado Production Cost Analysis, Orange County, 1941," Agr. Ext. Serv., Berkeley, Calif.

"Canadian Agriculture and the War," Dom. Dept. of Agr., Ottawa, Ont.

"Principal Methods of Share Renting and Compensation for Unexhausted Improvements in Four Type-of-farming Areas in Indiana," Agr. Exp. Sta., Lafayette, Ind., Bul. 464, Jan. 1942, O. G. Lloyd, H. S. Morine, Jr., and J. R. Hays.

"New Settlement Problems in the Northeastern Louisiana Delta," Agr. Exp. Sta., University, La., Bul. 335, Feb. 1942, P. E. Jones, J. E. Mason, and J. T. Elvove.

"Factors Affecting Profits from Dairy Herds," Agr. Exp. Sta., University, La., Bul. 338, Feb. 1942, D. M. Seath and E. W. Neasham.

"Ranch Organization and Operation in Northeastern Nevada," Agr. Exp. Sta., Reno, Nev., Bul. 156, Nov. 1941, G. Alvin Carpenter, Marion Clawson, and C. E. Fleming.

"The New York State 1942 Agricultural Outlook," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 472, Jan. 1942.

"Attitudes of Edgefield County Farmers Toward Farm Practices and Rural Programs," Agr. Exp. Sta., Clemson, S. C., Bul. 339, Feb. 1942, M. T. Matthews, D. R. Jenkins, and R. F. Sletto.

"Virginia's Marginal Population—A Study in Rural Poverty," Agr. Exp. Sta., Blacksburg, Va., Bul. 335, July 1941, W. E. Garnett and A. D. Edwards.

"Economic Conditions and Problems of Agriculture in the Yakima Valley, Washington: Part III. Fruit Farming," Agr. Exp. Sta., Pullman, Wash., Bul. 409, Oct. 1941, E. B. Hurd, C. P. Heisig, M. Clawson, H. F. Hollands, and B. H. Pubols.

Potash Extends the Life of Clover Stands

(*From page* 19)

That brings us to the matter of hay yields. From the dairyman's viewpoint these are important. In the following table all the yields are compared with those of the check plots which are rated at 100, and the data are for the 4-year average on this series of plots, 1938 to 1941, inclusive:

Treatment	*% of check*
Check	100
Superphosphate	99
Potash	179
Phosphate and potash	279
Complete fertilizer	307
Lime, 1 ton	98
Lime and phosphate	106
Lime and potash	196
Lime, phosphate and potash	286
Lime and complete fertilizer	303

The amounts of fertilizer used were 125 pounds of 60% muriate of potash, 400 pounds of 20% superphosphate and 100 pounds of nitrate of soda, all top-dressed annually in all treatments in which these materials were applied. Lime was not used in 1937, but the lime which was added had been applied in 1929. Manure was applied to all plots uniformly in 1936, during which year the land was in corn.

The tremendous response for potash is indicated by its comparative yield of 179. The curious minded may be interested in actual yields, which may be obtained by multiplying the percentages given by 1.145, which was the yield in tons of the check or untreated plots. Even more remarkable perhaps is the jump in yield to 279 when superphosphate and potash were used together. Nitrogen added to the superphosphate and potash (in the complete fertilizer) further increased the yield to 307.

Perhaps this is an unusual soil in the way it responds. As a matter of fact legumes have always responded very well to potash here, but they have also on other soils in New Hampshire where similar tests have been run. The chief difference brought out in our tests isn't the difference in potash response but in the response to superphosphate which has usually run higher in other tests than it did in this case. In all of our tests, however, potash appears to have a greater effect on persistence of legumes, whether clovers or alfalfa, than either lime or superphosphate.

Since an increased production of dairy products is of prime importance at this time, and since nitrogen is limited, our best bet appears to foster the production of legumes with ample potash. This can partly be done with manure. But the manure must be carefully protected so that its fertilizing value will be preserved since its potash content is very susceptible to leaching and washing away before it is applied. On fields such as the one here described, it is doubtful if manure can or should be used in amounts sufficient to supply all of the available potash that legumes require, even if it gets to the field with its full potash quota.

As a matter of fact, the response in hay yields to manure has fallen off quickly in this and other tests which we have conducted. The effect of manure used as a variable in the experiment in question was practically gone at the end of two years, and manure had no effect on clover longevity. This fact, coupled with the results of soil tests on these plots which show no accumulation of available potash even with annual top-dressings, leads us to believe that any available potash in manure is quickly rendered insoluble after its application by being fixed in the soil in some exchange complex. Unless manure is used, then, as an annual top-dressing or unless potash is applied annually, clovers are destined to go out.

Farmers often have reported that top-dressing an old hayfield with manure brings in clover, and have wondered why clover has appeared after an application of manure. We have always casually explained this phenomenon by saying that probably the manure carried clover seeds which had passed through the digestive tracts of the animals. Maybe that is a partial explanation, but after studying the results of the above experiment we are inclined to ascribe more credence to the idea that clover has come into the stand in these instances because manure temporarily raised the potash level of the soil.

There is a nitrogen shortage. There is always a deficiency of *good* cow hay in New England. This seems to be a good time to let potash "pinch-hit" for nitrogen by using more of it or taking better care of manure to grow more clovers. Farmers who find that their soils respond to potash, as this one does, and capitalize on that fact, will certainly be well repaid during the next few years by harvesting better hay with more clover in it and thereby adding to the nitrogen supply of the farm.

Legumes Will Furnish Needed Nitrogen

(*From page* 22)

the Soil Conservation Service in 1939 and cooperatively by the Alabama Experiment Station and the Soil Conservation Service in 1940 and 1941 served to confirm the earlier results obtained at Auburn. Trials conducted on farms in various parts of Alabama resulted in an increase of approximately 20 bushels of corn per acre following kudzu. Most of these trials were on land where yields of corn were extremely low before kudzu was planted. In general, farmers have been unwilling to plant kudzu on any except the most severely eroded portions of their farms.

Where cultivation of corn was limited to that necessary for weed control, a sufficient number of living plants were left to restore the stand of kudzu by the end of the growing season. Usually the stand recovered sufficiently to furnish a cutting of hay the year after corn was grown. Both recovery of stand and growth of plants were influenced by soil conditions. On areas where a considerable portion of the topsoil remained, recovery was rapid; whereas, on severely eroded, galled areas, recovery was not sufficient for a hay crop to be cut the year after corn was grown.

Lespedeza sericea has been used for soil improvement to only a limited extent, but results have shown that this deep-rooted perennial has great possibilities.

At the West Tennessee Agricultural Experiment Station at Jackson, sericea was planted in the spring of 1930 on land that normally produced 25 to 30 bushels of corn per acre. Seed or hay was harvested each year. Beginning in 1933 and each year thereafter two 1/40-acre plots of sericea stubble were turned and planted to corn. Corn has been planted on all plots each year since. Thus, it has been possible to study the immediate effect of sericea on corn yields and the residual effect through the ninth crop after sericea stubble was turned.

Sericea Increased Yields

Results of this experiment as reported at the Southern Association of Agricultural Workers at Memphis, Tennessee, in February 1942, by Ben P. Hazlewood, Station Superintendent, showed that the average yields in bushels per acre for the different years after sericea stubble was turned were: 9 first-year crops 70; 8 second-year crops 65; 7 third-year crops 59; 6 fourth-year crops 52; 5 fifth-year crops 46; 4 sixth-year

crops 39; 3 seventh-year crops 33; 2 eighth-year crops 32; and 1 ninth-year crop 26.

Several cases have been observed where farmers plowed areas on which lespedeza sericea was growing and planted corn. Increases in corn yields have been comparable to those obtained where corn followed kudzu. These increases have been obtained on land that had been severely eroded and was consequently in a low state of productivity when planted to sericea.

On much of the steep, eroded cropland in the South, it will be a slow and expensive process to restore a high level of soil fertility through the use of annual crops. It will be necessary to rehabilitate these soils under a cover of deep-rooted perennial legumes. After fertility has been restored under such a cover, annual legumes will be valuable in maintaining a high level of soil fertility.

In addition to soil fertility and degree of erosion, the slope and soil type have an important bearing on the kind of vegetation required to build and maintain a satisfactory level of fertility. On moderate slopes, where favorable soil types occur, annual and biennial legumes, particularly when grown in mixtures with grasses, are usually adequate for erosion control and for the maintenance of a satisfactory level of fertility, provided the land is sufficiently fertile to grow these crops satisfactorily. On steeper slopes and on soil types that are highly erodible, deep-rooted perennials will be useful in building up a satisfactory level of fertility and also for reducing erosion to a sufficient degree to maintain the soil in a productive state.

Although little has been said here about soil treatments required by the various legumes, it is generally understood by farmers and agricultural leaders that sufficient lime and fertilizer must be applied before satisfactory growth of legumes can be expected. It is necessary to give sufficient soil treatment to insure satisfactory growth if an adequate supply of nitrogen is to be expected.

Lack of seeds and plants will limit the acreage of many legumes during the war period unless definite steps are taken to produce and harvest the supplies needed. It is, therefore, of utmost importance that seed and plant production patches of adapted legumes be

Nitrogen from a crop of crotalaria that was turned under helped produce an excellent crop of corn on this North Carolina farm.

established on every farm. Although the total quantities of seeds and plants that would be required to plant the acreage of legumes needed in the South are almost inconceivably large, the quantities needed on each farm could be grown on a relatively small percentage of the cropland. Of equal importance with production will be the development of the habit of harvesting seeds and plants. When we become as conscious of the value of lespedeza, crimson clover, crotalaria, and other crop seeds as we are of the last scattered bolls of seed cotton, most farmers will find a way to get sufficient seed harvested to meet the needs of their own farms.

If we in the South take full advantage of the information that is available, we can, through the simple medium of legumes, draw upon the inexhaustible store of atmospheric nitrogen which the Master Builder of the Universe so wisely placed within the reach of all to use, but beyond the power of any to control. We may thereby produce in abundance the food and fiber crops required in the struggle to restore order in the world, and in so doing build for ourselves a safer and more profitable post-war agriculture.

Soil Bank Investments Will Pay Dividends

(*From page* 9)

the legume seedings the first year. Potash also seems to give greater vigor to the new seedings which aids in withstanding severe winters.

It would appear, therefore, that the indirect effect of both phosphate and potash in the establishment of deep-rooted, healthy legume seedings is as much responsible for increases in the yield of hay the second year as is the actual plant food supplied.

On the dairy farm where small grain, legumes, and corn are grown in rotation, we recommend that fertilizers be applied at the time of seeding down to legumes. We have been urging Wisconsin farmers to replace their old grain drills with the new combination fertilizer drills which sow grain, fertilizer, and grass seed all in one operation. Thousands of Wisconsin farmers are now equipping themselves with these new combination drills or attachments for their old drills. We point out that larger increases in yield of grain are usually secured where the fertilizer is applied in direct contact with the seed at the time of seeding. Manufacturers of grain drill equipment tell us that more than 95% of all new drills sold in Wisconsin the past two years are the combination fertilizer type.

For years farmers in Wisconsin have applied small amounts of fertilizer with attachments on their corn planters. The 3-18-9, 4-16-4, or 3-12-12 mixtures are recommended for corn at rates of from 90 to 125 pounds per acre. This small amount of fertilizer, drilled or checked with the corn at the time of planting, results in stronger and more vigorous growth in the early part of the season, advances maturity in the fall, and increases the yield and improves feeding quality of the corn. Wisconsin, of course, is situated in a northern latitude with a short growing season. We frequently experience periods of cool weather following corn planting, and thus the benefits from hill application of fertilizer containing nitrogen are greater than may be expected in states farther south.

While Wisconsin farmers have for many years used some commercial fertilizer on special crops such as canning peas, sugar beets, onions, and potatoes, the more general use of fertilizers on small grain and seedings of clover and alfalfa on the dairy farms is a practice which we are recommending. We advise farmers that the application of from 200 to 300 pounds of commercial

fertilizer per acre at the time of seeding down to clover and alfalfa and repeated every rotation will gradually build up the fertility of the farm as a whole. Larger yields of grain and better crops of alfalfa and clover will add to the home-grown feed supply, will cut feed costs, and will increase the possible livestock-carrying capacity of our farms.

There never has been a period in history when the opportunity for the profitable use of commercial fertilizer in Wisconsin was as great as it is right now. A program of liberal fertilization of all feed and food crops is recommended. The generous application of commercial fertilizers will not only contribute to our Food for Freedom effort and give us a liberal return on the investment, but at the same time we will be building up reserves of plant food in our greatest national bank of potential wealth, the soil.

Purpose and Function of Soil Tests

(*From page* 16)

tions. The success of soil testing lies in the complete understanding of these limitations. There is no doubt that, within certain reasonable limits, they will afford much useful information relative to the supply of available plant nutrients. In addition, they can be employed to detect the presence of toxic elements, such as aluminum. They give, beyond doubt, a clear differentiation between soils of high nutrient level and those of low nutrient level. One of the most important uses of these tests today lies in the detection of low levels of any given nutrient. In some cases only one or two elements may be low, and in others an extremely unbalanced condition may exist. This type of information is useful in determining the nature of soil amendments and management practices to be followed.

When rapid soil tests are viewed from the standpoint of their value and use in the hands of properly qualified personnel, there is little that can be said today to discourage their use. Within the past decade these tests have rendered a tremendous service to farmers in many states. In the future, in view of constant improvements in methods, more complete standardization, and increased experience in interpreting and applying the results, the benefits to agriculture should be increasingly greater.

Nutritional Information from Plant Tissue Tests

(*From page* 13)

phosphorus in 52%, and potassium in 24% of the cases. In 86% of the cases plant growth was restricted by at least one of the three elements studied.

Field tests indicated that nitrogen, phosphorus, and potassium were needed for the crops on 2 fields, nitrogen and potassium on 4, phosphorus alone on 6, potassium alone on 2, and nitrogen and phosphorus on 5.

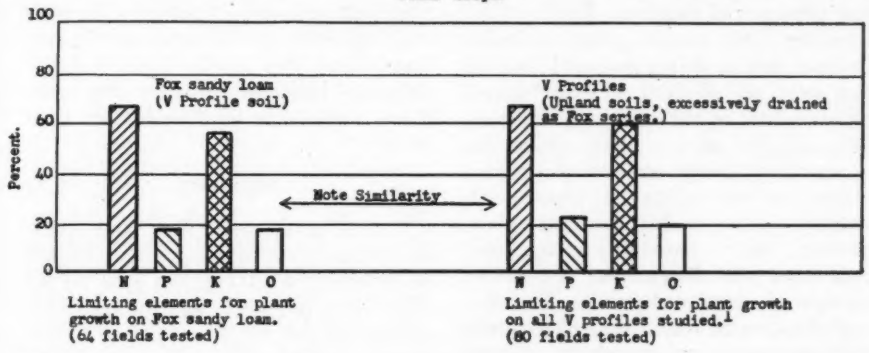
In the "VIII" profile group of soils consisting of Brookston silty clay loam, Westland loam, Ragsdale loam, and Washtenaw silt loam, nitrogen was one of the limiting factors in 63% of the cases. This fact is somewhat startling as it was previously thought that these soils, dark on the surface, or high in organic matter, usually carried sufficient available nitrogen for maximum plant

growth. Phosphorus was one of the limiting factors in 20% of the cases and potash in 63%. Here it seems that the first nutrient deficiences were nitrogen and potassium to about the same extent.

From previous chemical analysis [5] it was found that many group VIII soils had 30,000 pounds of potassium per acre in the surface 6 to 7 inches. Evidence, therefore, indicates the availability of a nutrient is of greater importance than the total supply in the soil. With the high-yielding soils, as represented by groups VIII, X, and bottom lands, the available supply of nitrogen and potassium seems to be

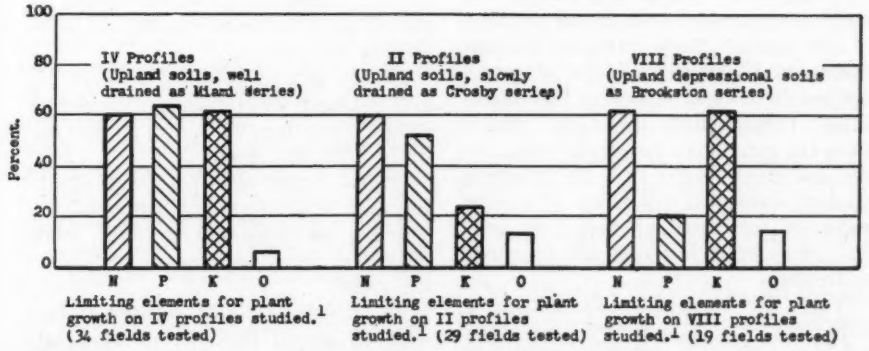
[5] *See Soil Survey publication of Vermillion and Rush Counties, Indiana.*

Percentage Deficiencies of Nitrogen, Phosphorus, and Potassium, as Well as No Deficiencies of These Plant Nutrients, in Certain Indiana Soil Groups as Found by Plant Tissue Tests of General Field Crops.



Limiting elements for plant growth on Fox sandy loam. (64 fields tested)

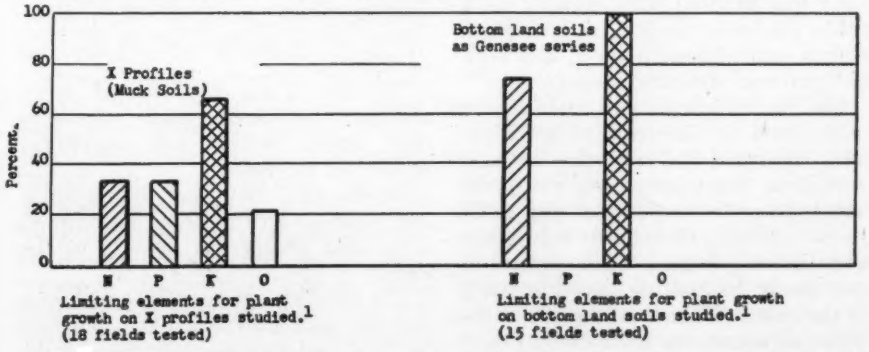
Limiting elements for plant growth on all V profiles studied.[1] (80 fields tested)



Limiting elements for plant growth on IV profiles studied.[1] (34 fields tested)

Limiting elements for plant growth on II profiles studied.[1] (29 fields tested)

Limiting elements for plant growth on VIII profiles studied.[1] (19 fields tested)



Limiting elements for plant growth on X profiles studied.[1] (18 fields tested)

Limiting elements for plant growth on bottom land soils studied.[1] (15 fields tested)

[1] The soil types studied for the various graphs are listed in their respective soil drainage groups.

limited in spite of the large supply within these soils.

On all the crops studied on the soils of the VIII profile group, it was found that the plant growth was limited in 85% of the cases by one or more of the three elements studied, or only 15% of the crops were receiving a balanced diet in sufficient quantities. Tests indicated that nitrogen, phosphorus, and potassium were needed by the crops on 2 fields, nitrogen and potassium on 13, and phosphorus alone on 2.

In the "X" profile group of soils, Carlisle muck, Edwards muck, muck over sand, and Walkill silt loam [6] nitrogen was one of the limiting factors in 33% of the cases. Here again the presence of a large amount of organic matter did not supply the plants with sufficient nitrogen for optimum plant growth. As is commonly recognized, potassium was deficient as a nutrient on most of these mucky soils. Nitrogen and phosphorus were deficient in about half as many cases as potassium, and both nitrogen and phosphorus in 33% of the cases. Muck farmers lead all others in supplying all the elements needed by a crop, still they had many cases of insufficient nutrition. Muck soils are generally considered very fertile, but nevertheless 78% of the crops studied showed a deficiency of one or more of the three elements, or only 22% were receiving adequate balanced nutrition.

With the 12 muck soils studied, a deficiency of both nitrogen and potassium was limiting plant growth on 4 fields, potassium alone on 4, both phosphorus and potassium on 2, and both nitrogen and phosphorus on 2.

On bottom land soils, which are represented by Genesee silt loam, Genesee loam, and Eel silty clay loam, it was found that nitrogen was one of the limiting factors in 73% of the cases. In no case was phosphorus one of the first limiting factors, while potassium was one of the limiting factors in 100% of the cases. Therefore, the prime nutrient deficiency on these bottom land soils seems to be only potassium and nitrogen in this respective order. In no case were the crops receiving adequate balanced nutrition. On bottom soils the moisture supply is conducive to producing large crops. This may cause even a fairly high supply of a nutrient to become a limiting factor in production. Yields can be increased if more of the relatively deficient nutrient is supplied.

On the bottom lands, 11 fields indicated nitrogen and potassium were both limiting corn production, and potassium alone in 4 cases. This evidence seems to challenge the belief that fertilizers need not be used on bottom land soils.

[6] *Walkill silt loam was included in this group as it is underlain by muck.*

Summary

Purdue plant tissue tests were made on different crops growing in 195 fields on 26 different soil types in order to get additional diagnostic nutritional information on the soil types and to obtain current information which could be passed on to the farmer as an aid to his fertility program.

On the second bottoms, or V profile soils, nitrogen was limiting plant growth in 68%, potash in 60%, and phosphorus in 24% of the cases.

On the light colored, rolling, central Indiana upland soils, nitrogen was limiting plant growth in 60%, phosphorus in 64%, and potash in 62% of the cases.

On the level, light colored upland soils of central Indiana, nitrogen was limiting plant growth in 60%, phosphorus in 52%, and potash in 24% of the cases.

On the dark, depressional soils, nitrogen was limiting plant growth in 63%, potash in 63%, and phosphorus in 20% of the cases.

On the muck soils, potash was limiting plant growth in 66%, nitrogen in 33%, and phosphorus in 33% of the cases.

On the first bottom soils, potash was limiting corn growth in 100%, nitrogen in 73%, and phosphorus in none of the cases.

These plant tissue test data were combined and summarized according to the soil drainage groups; 78% or more of these soils were producing crops that were inadequately supplied with either nitrogen, phosphate, potash, or some combination of these nutrients. Plant nutrients may be only partially available to crops even though soils contain large amounts of them.

The Senior Draft

(*From page* 5)

try to force anybody without the inner light of inclination to try hobnobbing with the Junior phalanx. It might prove to be a flop and set the cause back considerably. But here and there we can develop older heads with young aspirations to take a course of this nature under the guidance of men who have a real hold on young men and boys. It seems rather neglectful on the whole to herd the coming Twenty-oners into the Army without a preliminary tutelage. Maybe veterans of the first world war could take a hand in this ambitious task.

In proposing such a plan, it seems to me that Himmler and Hitler and his cohorts have rather beaten us to a sense of the vital importance of teamwork between Youth and Maturity; and if they can teach sadistic and fatalistic philosophy, why can't we senior draftees organize to coach our own future soldiers in the opposite manner? We can give them some underlying principles of what we have called the "American Dream," and in their hands put the weapons to use with the motive and the ideals. Indeed this very thing is what this war lacks—a goal and not a goad, vision instead of vengeance!

At least we can give them something besides a bottle of pop and a pat on the back when they are called to the colors—and that's worth considering. Conscription is hard enough, but consecration makes it easier.

But prior to setting up as mentors and consecrators of the young warriors, I suppose most of us Oldsters must crystalize our thoughts anent the so-called American Dream. We have lived through years of glory and goodness here and have seen many praiseworthy deeds performed, but we have also seen the tarnish on our democracy and must be frank to reveal it and denounce it. We cannot go forth as armorers of the knights of liberty or keep their home fires burning unless we are honest about our own mistakes, and pledge what strength we retain to make the American Dream come true.

Ours has been a great heritage and a life of marvel, but material things and blatant optimism, money-grabbing and figure-worshiping have intruded too often on our search for quality and spiritual values.

Yet our best service to the younger generation of men, those who have gone as well as those who are about to go, is to remember the old adage that actions speak louder than words. Lots of us may not incline toward preachment or have rapt ideas to impart with bated breath to the young comrades. Others will find deaf ears owing to their inability to make the message about the American Dream ring true.

Therefore, we must go about our daily routine of business and production aware that what we do will carry more weight in building up that crusading spirit than all the philosophy we might spill. If we wrangle and complain about government rules and wartime restrictions; if we voice the whine of some pressure group; if we take short cuts and try to hoard valuable necessities; if we seek the main chance and insist on excess profits; if we try to inject partisan politics into grave human issues;—these misdeeds

will make the soldiers wonder if it's worth while to be homesick or not. And those who are yet to enroll for the draft will sign their names with cynical indifference, feeling that they are just pawns and not patriots.

So when you look at it this way you'll begin to see that after all us old draftees control more forces and direct more object lessons than one might suppose possible. For if an expeditionary army drifts away from America and then America goes sour and stagnant, wouldn't it be a hell of a trick to play on the heroes?

Then along with the serious, owly side of this nation-saving business there is bound to be room for harmless fun and care-banishing sports. I think maybe this is a field also where some of the Oldsters will find scope for talents long since forgotten in the hurly-burly of trade and profession.

This activity is bound to come in mighty handy at times when the news from abroad is bad. It's going to be our part as seniors to strike a nice balance between the grim preparedness and guard-mounting affairs and the simple pleasures that endear our country to us by old associations.

I AM not one who decries the dancing and the game-playing features that have met so much thoughtless jibing during the early days of civilian defense. Even the Army has its moments of relaxation, and why should we stay-behinds cease our tension-easing foolishness? Organization of keen squads of athletes and entertainers among the younger generation likewise points to another task for the senior expert.

No, it doesn't appear to be vitally necessary for many of the men between forty-five and sixty-five to rush off and volunteer, when so many important enterprises call for their unselfish attention on the home front. Besides, unless a man in that age limit is qualified by experience for active duty, he has no business crowding himself into the military ranks. He'd only be in the way and dilute the payroll. The hospitals will be full enough without subjecting them to the misery of keeping up an old man's infirmary.

And finally, I want to reprint a cordial and appreciative letter that appeared in a Midwest newspaper right after the Oldsters checked in with Uncle Sam. Somehow it did me a heap of good to read it. It struck a vibrant note of faith and good will which we all need plenty of in stock for the next few years.

"THE other day we registered the 'old men' of America—the fifties and the sixties. As a member of the younger generation I take off my hat to the gallant men who won the last World War. Without exception, they were courteous, cooperative and patient; ready to a man to defend your land and mine; willing and anxious to work, to fight, to help in whatever way they can to preserve America, which to many of them is an adopted land. They are now asking, 'What can I do and how soon can I do it?'

"Of the forty-one men I registered, only two were unemployed; both were physically handicapped, one a veteran gassed in the last war. I was impressed with their youthfulness, their apparent physical fitness, their sprightliness and their magnificent spirit.

"If this war produces no other good, perhaps it will at least convince employers that a man's usefulness does not end when he passes the forty-mark. Youth may yet learn that 'the old fogies' have a few tricks up their sleeves. Old heads and young blood can and must mix. Let Young America not forget that the 'old men' built and preserved our Union.

"I salute the older men who will keep the wheels turning while our young ones keep the planes flying.—M. H."

And so if that's the way the rest of the country regards us Oldsters, we won't have to wear old medals and tell old stories to retain self-respect among the Nation's loyal defenders.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Grow More Corn (South)
Fertilizing Small Fruits (Pacific Coast)
Potash Hungry Fruit Trees (Pacific Coast)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (Northeast) and (Canada)
Fertilize Pastures for Better Livestock (Pacific Coast)
What You Sow This Fall (Canada)
Home-grown Grains for Profitable Hogs (Canada)
What About Clover? (Canada)
Of Course I'm Interested (Pastures, Canada)

Reprints

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THE AMERICAN POTASH INSTITUTE
1155 16TH STREET, N. W. WASHINGTON, D. C.

THAT MAN AGAIN

Among the people who dislike hearing a speaker read a speech, was an old colored woman, who went to church where the young minister always read his sermons. Someone asked her how the preacher was getting on.

"How's he gettin' on?" she repeated scornfully. "Jes like a crow in a corn field—two dabs an' a look-up."

He: "Please?"
She: "No."
He: "Just this once."
She: "No, I said."
He: "Aw hell, ma—all the rest of the kids are going barefoot."

Auto ages: Honk, ah-ooga, beep-beep, tooot, x&!zx!!*!

A drunk boarded a two-story bus; it was crowded, but he finally found a seat by the driver.

He talked and talked, and finally the driver tactfully suggested that he go on the top deck and enjoy the fresh air and wonderful view.

The drunk amiably clambered through the crowd and disappeared upstairs. But in a few minutes he was back.

"What's the matter? Didn't you like the fresh air, or the view?" asked the driver resignedly.

"Yep, nice view, nice air," answered the drunk. "But, 'tain't safe—no driver."

A couple of nurses were sneaking into the hospital late one night when they met two young internes sneaking out.

"Sh-h-h," warned one of the girls. "We're just coming in after hours."

"Sh-h-h," whispered one of the internes. "We're just going out after ours."

An American applied at a recruiting office to enlist.

"I suppose you want a commission," said the officer.

"No, thanks," was the reply, "I'm such a poor shot, I'd rather work on straight salary."

"Yassum," said Callie, the Negro cook, "I been engaged for goin' on ten days."

"Who is the bridegroom?"

"Willum, he's a mighty nice man."

"Have you known him long?"

"Yes, indeedy. Don't you remember, Miz Aronoff, dat about two weeks ago you lemme off one day right after dinner time so's I could get to the fun'el of a lady friend of mine?"

"Yes, I do."

"Willum, de one I'm fixed to marry is de departed's husband."

A cow barn is a lot like a tavern. Go in either one for half an hour and everybody knows about it all the rest of the day.

SURER PROTECTION AGAINST APHIDS FOR POTATOES AND TOMATOES

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INSECTICIDAL SPRAY

Guard your crops with this deadly new form of Rotenone... compatible with Bordeaux to kill aphids, control blight with ONE spray!

Now—our chemists have found a way to free *all* of ROTENONE'S extra bug-blasting power and put it to work protecting your potatoes and tomatoes from aphids.

Our exclusive SYNTONE solvent dissolves the Rotenone, draws it right out of the derris, makes it mix perfectly with water. And this solvent, too, is an insecticide — increasing the poison's effectiveness against both "chewing" and "sucking" insects, and their larvae, nymphs and eggs.

LASTS LONGER! There is an anti-oxidant in SYNTONE that protects the Rotenone from sunlight and air and water — makes it last about 10 days with one application.

ECONOMICAL! A little covers a big area. SYNTONE is a concentrated liquid which you dilute to hundreds of times its volume with water.

MIXES WITH BORDEAUX IN ONE SPRAY! SYNTONE can be mixed with many fungicides (copper, sulphur or other types) to control *both* insects and fungus diseases with *one* spray! A time-saver that cuts spraying costs in half!

SAFE—can't harm plants, fruit, people or animals. Non-inflammable.

KILLS both "chewing" and "sucking" insects and their larvae, nymphs and eggs.

DOESN'T CLOG sprayer nozzle or corrode tank.

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A motion picture depicting the value, uses, and fertilizer requirements of Ladino clover in *Northeastern* agriculture.

16mm., silent, color, running time 45 min. (on 400-ft. reels).

"Ladino Clover Pastures"

Shows proper fertilization for best use of Ladino clover by beef and dairy cattle, sheep, and poultry in the *West.*

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Other 16MM. COLOR FILMS AVAILABLE

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Machine Placement of Fertilizer
Potash from Soil to Plant
Potash Deficiency in Grapes and Prunes
New Soils from Old

We shall be pleased to loan any of these films to agricultural colleges and experiment stations, county agricultural agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

MAKE YOUR FALL REQUESTS NOW

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